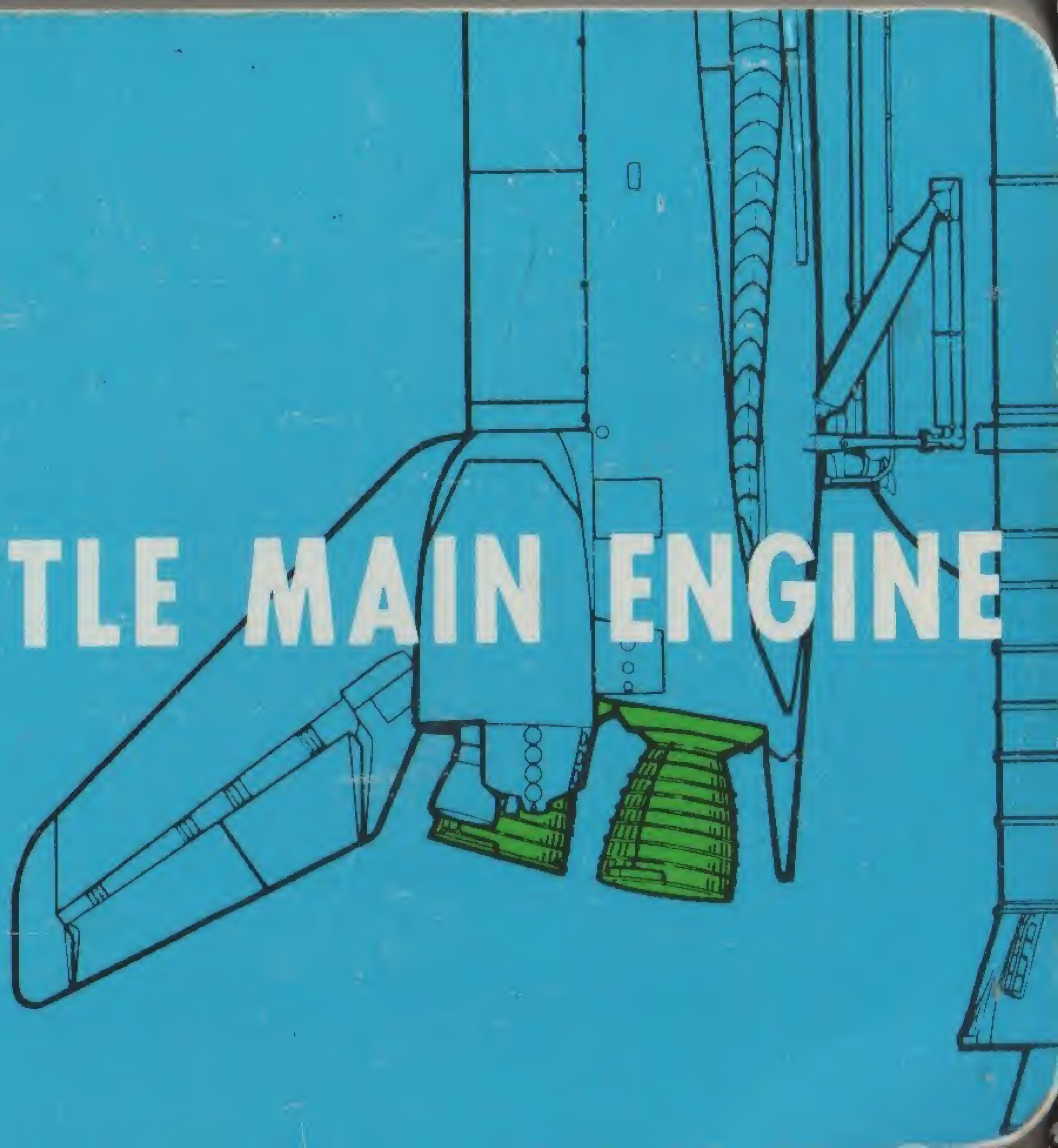


POCKET DATA
RI/RD87-142

SPACE SHUTTLE MAIN ENGINE



Rockwell
International
Rocketdyne Division

RI/RD87-142

POCKET DATA

SPACE SHUTTLE MAIN ENGINE

PART NUMBER RS007001

PREPARED BY
ROCKWELL INTERNATIONAL,
ROCKETDYNE DIVISION

23 MARCH 1989

INTRODUCTION

THIS POCKET DATA PROVIDES FINGERTIP INFORMATION FOR PERSONNEL ASSOCIATED WITH THE SPACE SHUTTLE MAIN ENGINE. THE DATA IS TECHNICAL IN NATURE AND ACCURATE AS OF THE DATE OF PUBLICATION. THIS POCKET DATA SHOULD BE USED FOR REFERENCE ONLY.

THIS POCKET DATA IS DIVIDED INTO 5 SECTIONS AS FOLLOWS:

SECTION I.	SPACE SHUTTLE VEHICLE/SSME SYSTEMS AND OPERATION
SECTION II.	SPACE SHUTTLE MAIN ENGINE (SSME) DESCRIPTION
SECTION III.	GROUND TURNAROUND OPERATIONS AND MAINTENANCE
SECTION IV.	SSME GROUND SUPPORT EQUIPMENT
SECTION V.	SHUTTLE FRF/STS LAUNCH HISTORICAL DATA

REVISIONS TO THIS POCKET DATA WILL BE MADE AS NECESSARY AND AS FURTHER INFORMATION BECOMES AVAILABLE. DESTROY OUTDATED POCKET DATA PUBLICATIONS UPON RECEIPT OF REVISED COPY.

COMMENTS AND SUGGESTIONS REGARDING INFORMATION CONTAINED IN THIS PUBLICATION SHOULD BE DIRECTED TO THE ROCKETDYNE FIELD ENGINEERING & LOGISTICS DIRECTOR, DEPARTMENT 579, CANOGA PARK, CALIFORNIA.

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ABBREVIATIONS AND ACRONYMS

AFV	ANTI-FLOOD VALVE	MCC	MAIN COMBUSTION CHAMBER
ASI	AUGMENTED SPARK IGNITER	MFV	MAIN FUEL VALVE
CCV	CHAMBER COOLANT VALVE	MOV	MAIN OXIDIZER VALVE
CCVA	CHAMBER COOLANT VALVE ACTUATOR	MPL	MINIMUM POWER LEVEL
FASCOS	FLIGHT ACCELERATION SAFETY CUTOFF SYSTEM	MR	MIXTURE RATIO
		MVA	MAIN VALVE ACTUATOR
FBV	FUEL BLEED VALVE	OBV	OXIDIZER BLEED VALVE
FPB	FUEL PREBURNER	OPB	OXIDIZER PREBURNER
FPL	FULL POWER LEVEL	OPOV	OXIDIZER PREBURNER OXIDIZER VALVE
FPOV	FUEL PREBURNER OXIDIZER VALVE		
HEX	HEAT EXCHANGER	PB	PREBURNER
GCV	GASEOUS OXYGEN CONTROL VALVE	PCA	PNEUMATIC CONTROL ASSEMBLY
HGM	HOT-GAS MANIFOLD	PBVA	PREBURNER VALVE ACTUATOR
HPFTP	HIGH-PRESSURE FUEL TURBOPUMP	RIV	RECIRCULATION ISOLATION VALVE
HPOTP	HIGH-PRESSURE OXIDIZER TURBOPUMP		
		RPL	RATED POWER LEVEL
HPV	HELIUM PRECHARGE VALVE	RVDT	ROTARY VARIABLE DIFFERENTIAL TRANSFORMER
LPFTP	LOW-PRESSURE FUEL TURBOPUMP		
LPOTP	LOW-PRESSURE OXIDIZER TURBOPUMP	SRB	SOLID ROCKET BOOSTER
		SSME	SPACE SHUTTLE MAIN ENGINE
LRU	LINE REPLACEABLE UNIT	VEEI	VEHICLE ENGINE ELECTRONICS INTERFACE
LVDT	LINEAR VARIABLE DIFFERENTIAL TRANSFORMER		

SECTION I

SPACE SHUTTLE VEHICLE/SSME SYSTEMS AND OPERATION

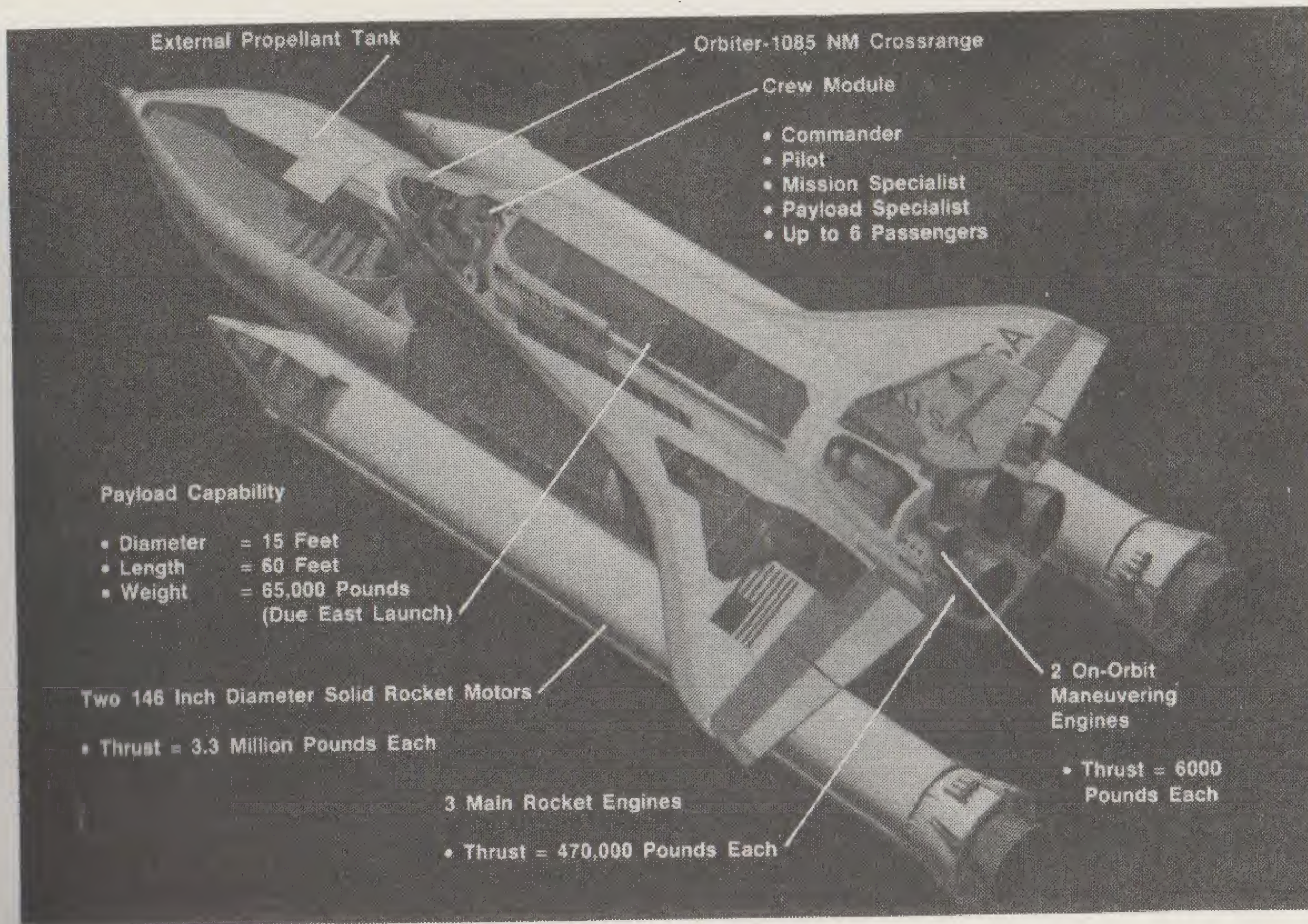
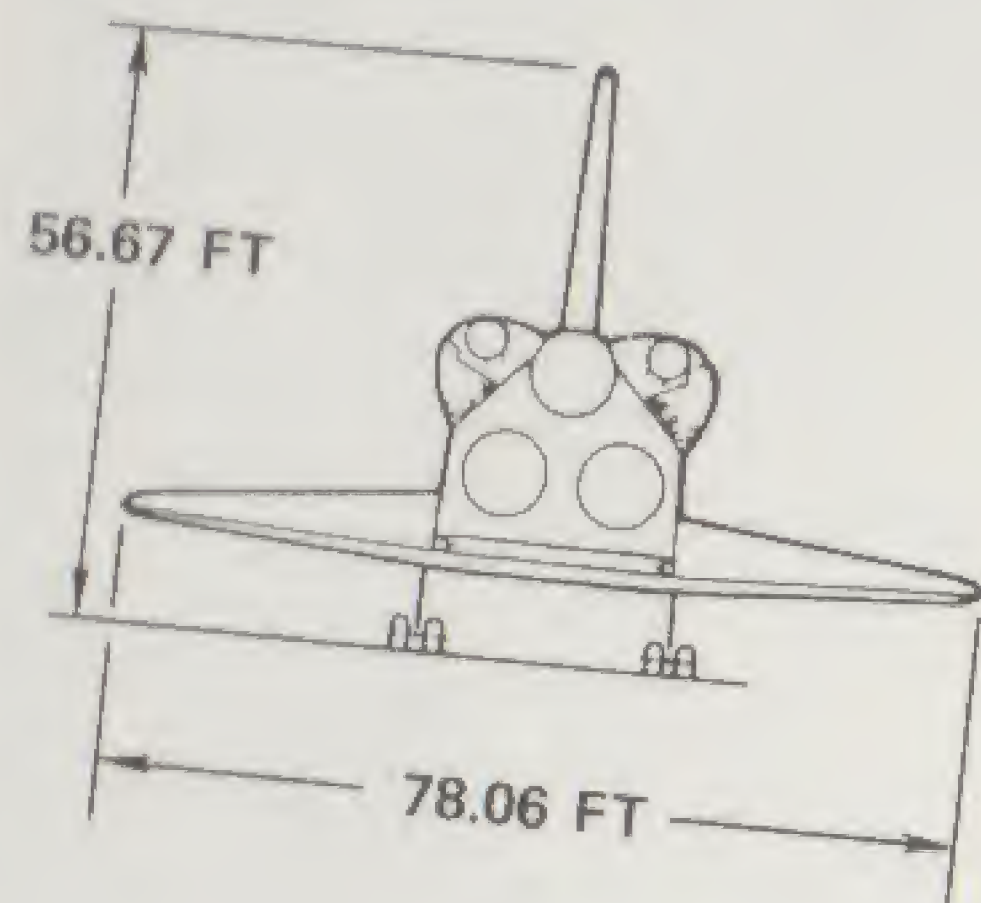


FIGURE 1-1. SPACE SHUTTLE VEHICLE



ORBITER	150,000 LB DRY*
SRB (2)	1,292,000 LB EA
ET	1,655,600 LB

*PLUS PAYLOAD AND CONSUMABLES
WEIGHTS APPROXIMATE

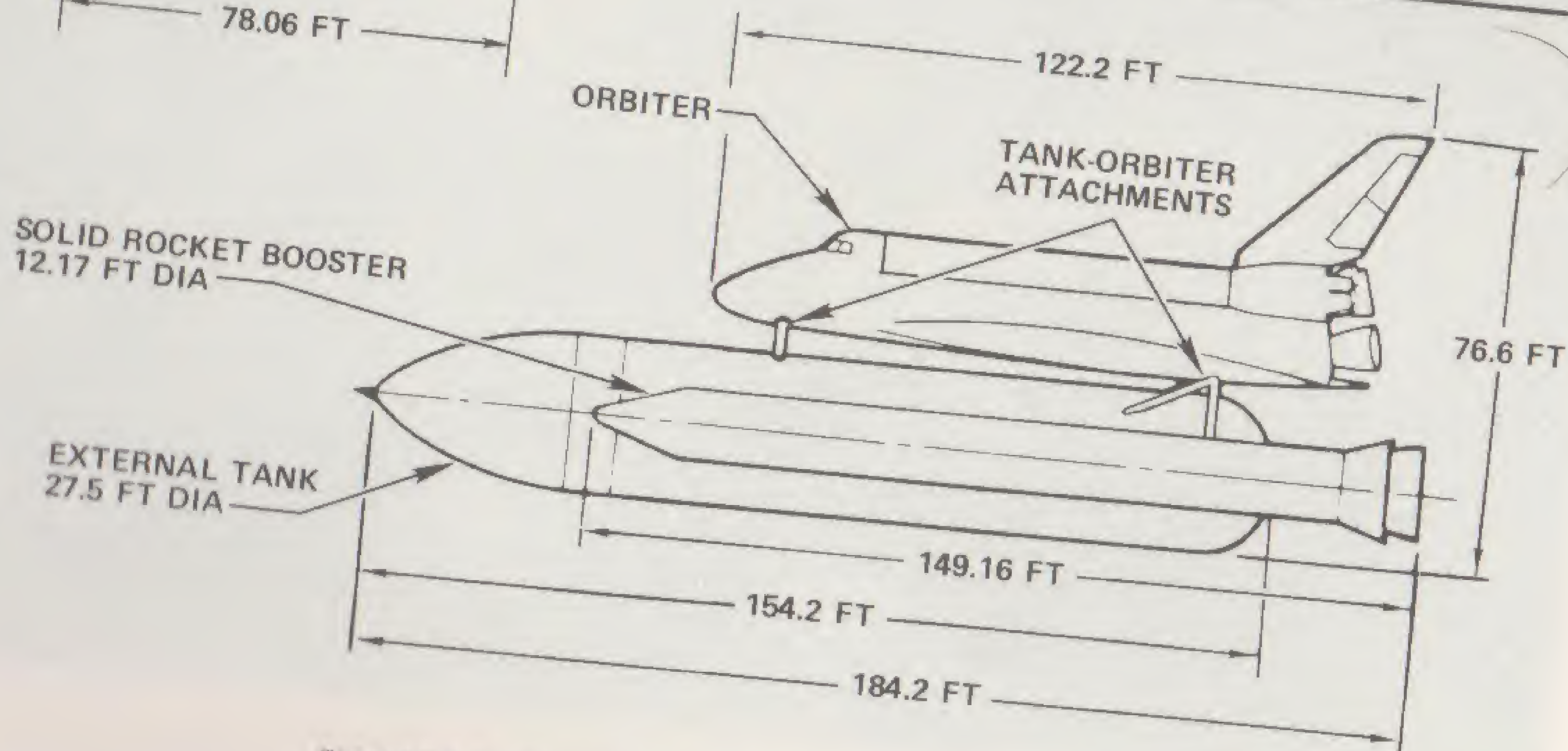


FIGURE 1-2. SPACE SHUTTLE STATISTICS (SHEET 1 OF 2)

WEIGHT

GROSS LIFTOFF:

4.5 MILLION LBS

ORBITER LANDING:

VARIES DEPENDENT UPON MISSION

THRUST

SOLID ROCKET BOOSTERS (SRB) (2):

3.3 MILLION LBS OF THRUST EACH AT SEA LEVEL

ORBITER MAIN ENGINES (3):

375,000 LBS OF THRUST EACH AT SEA LEVEL
(100% OF RATED POWER LEVEL)

TOTAL SYSTEM:

7.7 MILLION LBS OF THRUST AT SEA LEVEL

CARGO BAY

DIMENSIONS:

60 FT LONG, 15 FT IN DIAMETER

PAYLOADS:

UNMANNED SPACECRAFT TO FULLY EQUIPPED
SCIENTIFIC LABORATORIES

FIGURE 1-2. SPACE SHUTTLE STATISTICS (SHEET 2 OF 2)

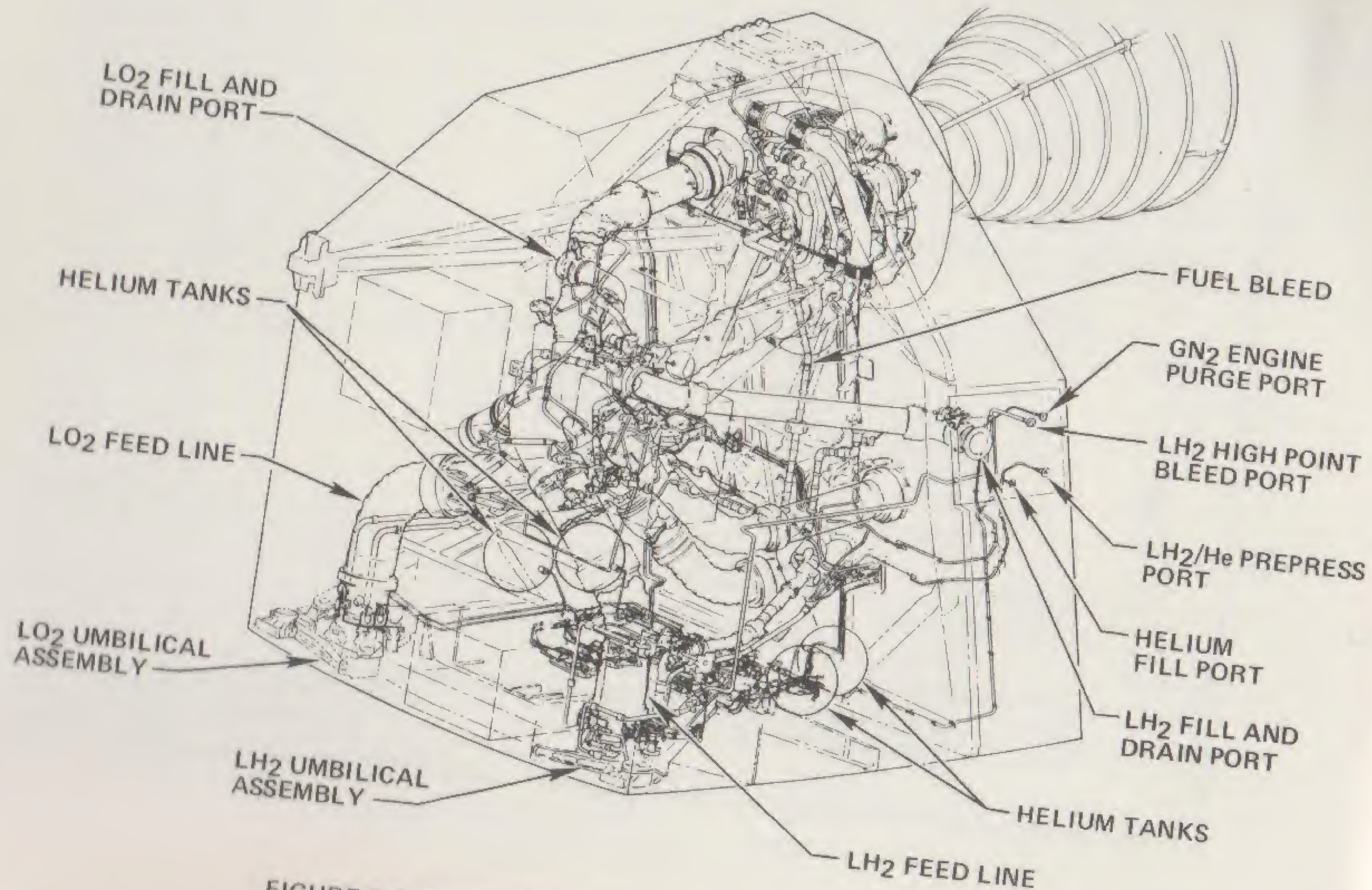


FIGURE 1-3. PROPULSION SYSTEM COMPONENT/LINE LOCATOR

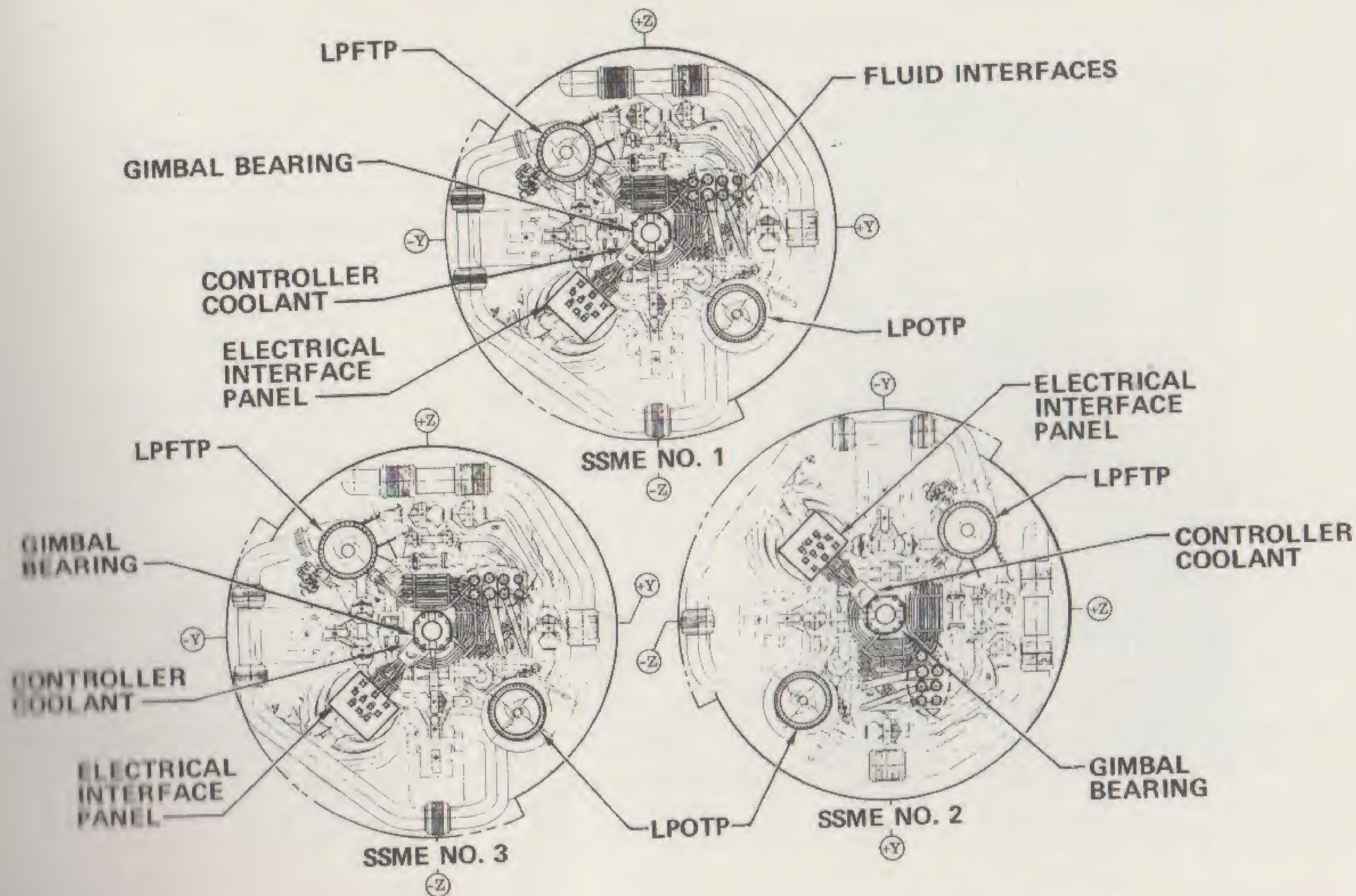


FIGURE 1-4. SSME INSTALLATION ORIENTATION AND INTERFACES (VIEW LOOKING AFT)

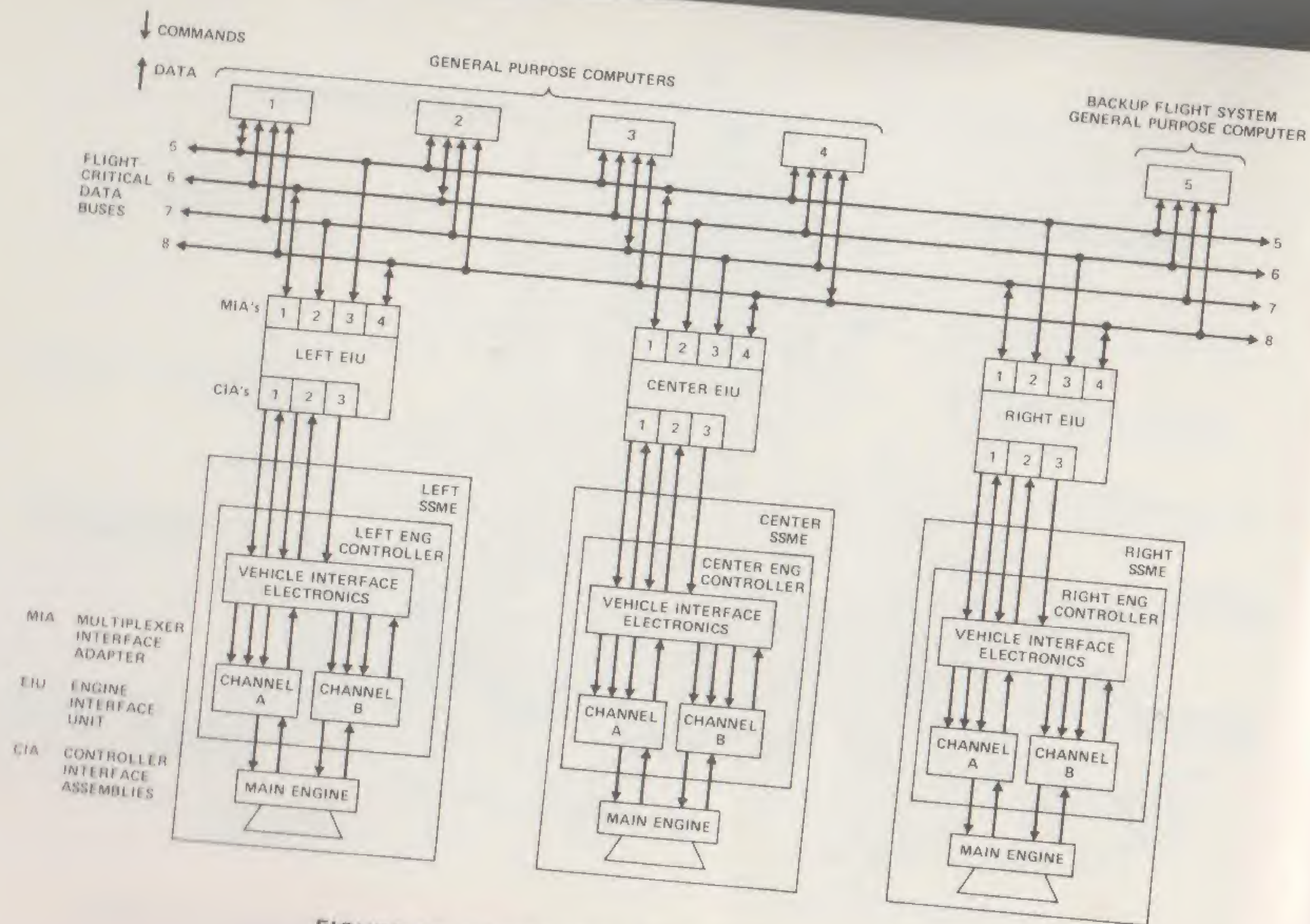


FIGURE 1-5. ORBITER/SSME AVIONICS INTERFACE

■ PROPELLANTS	OXYGEN/ HYDROGEN
■ RATED POWER LEVEL (RPL) 100%	470,000 LBS
■ FULL POWER LEVEL (FPL) 109%	512,300 LBS
■ CHAMBER PRESSURE	3280 PSIA @ FPL
■ SPECIFIC IMPULSE AT ALTITUDE	453.5 SECONDS
■ THROTTLE RANGE	65 TO 109%
■ WEIGHT	7000 LBS
■ DESIGN LIFE	27,000 SECONDS 55 STARTS
■ FULL POWER LEVEL	14,000 SECONDS

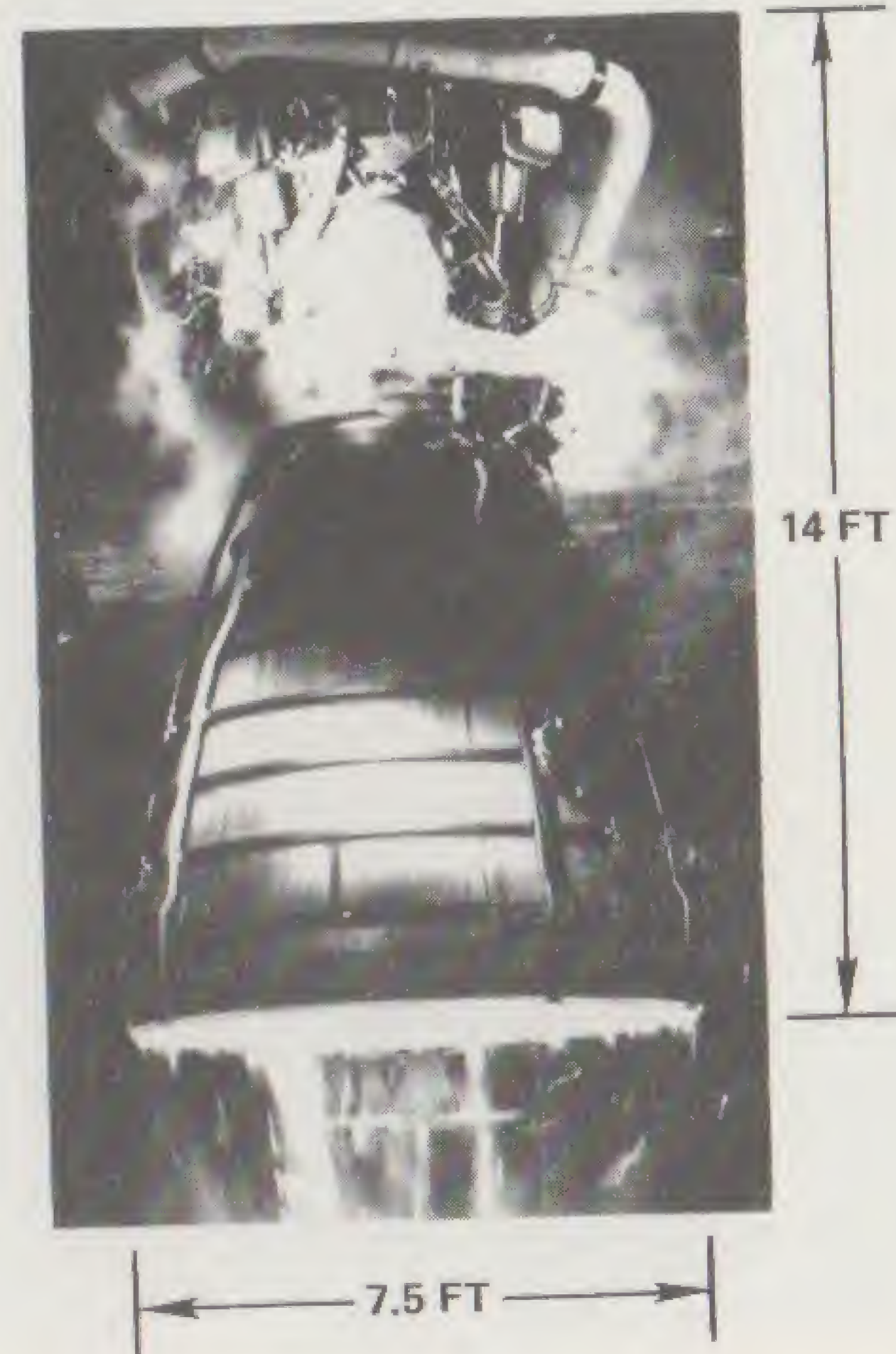


FIGURE 1-6. SPACE SHUTTLE MAIN ENGINE CHARACTERISTICS

18 Engines Have Flown in 27 Launches

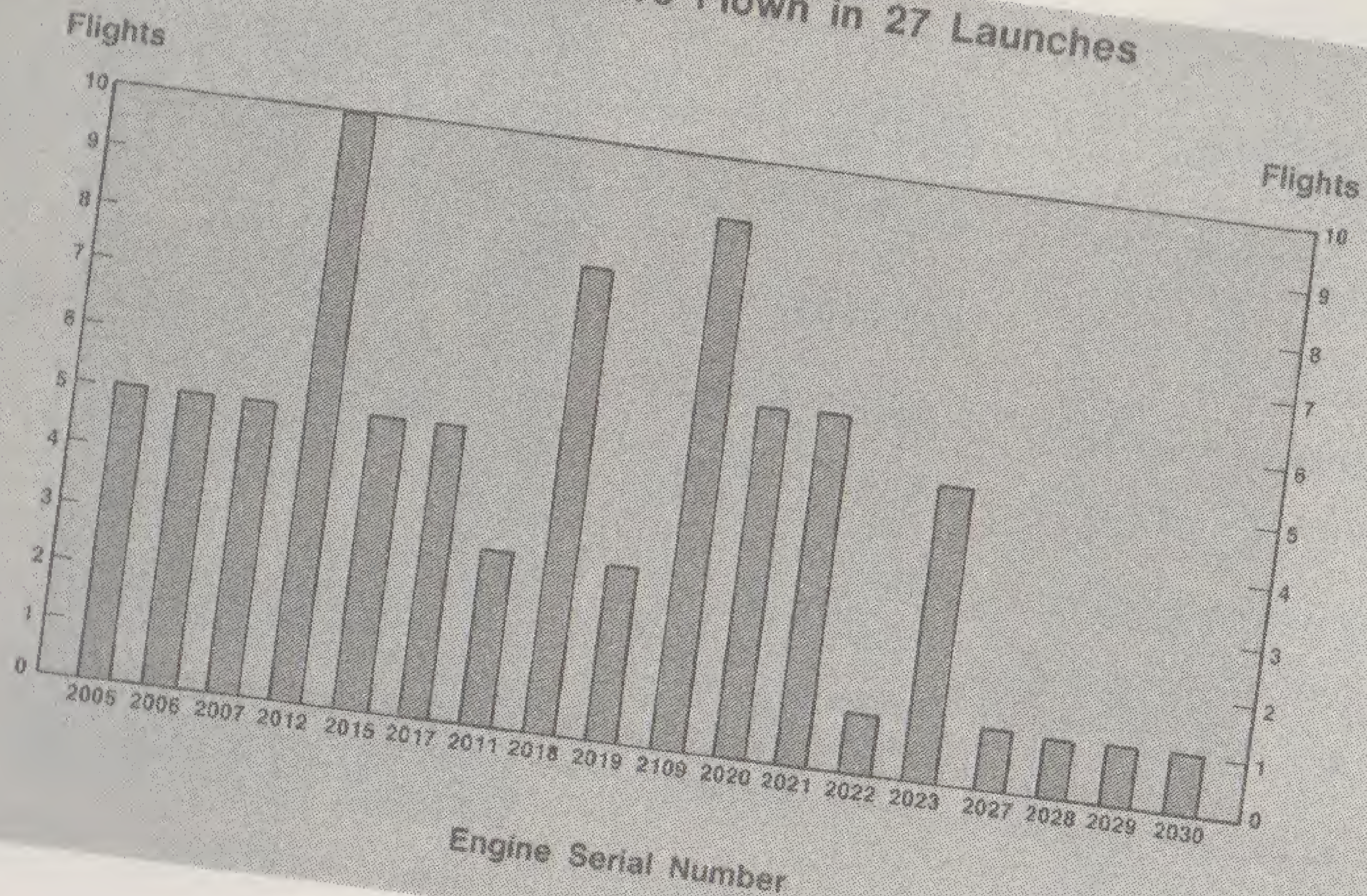


FIGURE 1-7. SSME FLIGHT EXPERIENCE

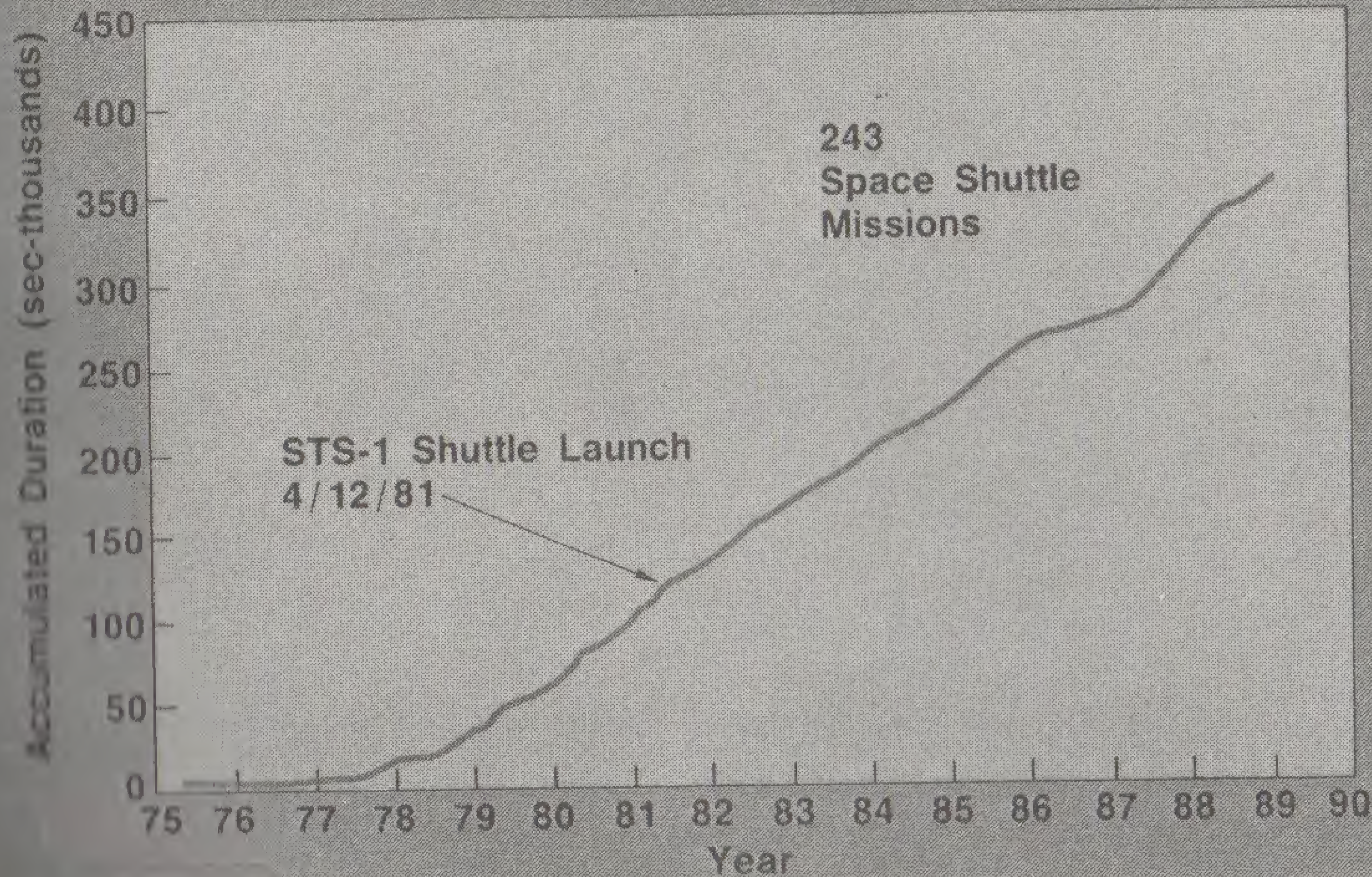


FIGURE 1-8. SSME HOT-FIRE SUMMARY

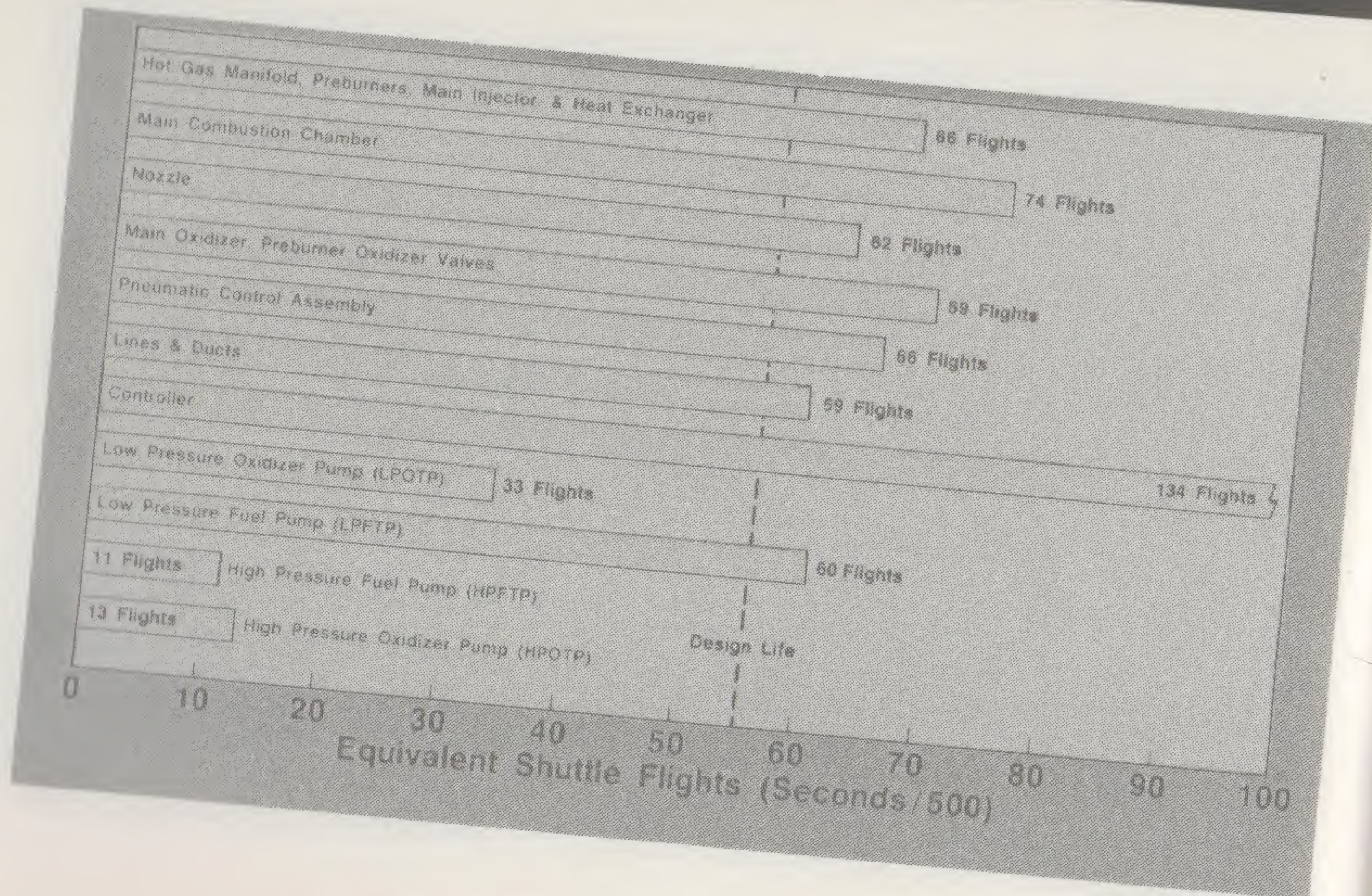


FIGURE 1-9. DEMONSTRATED SSME CAPABILITY

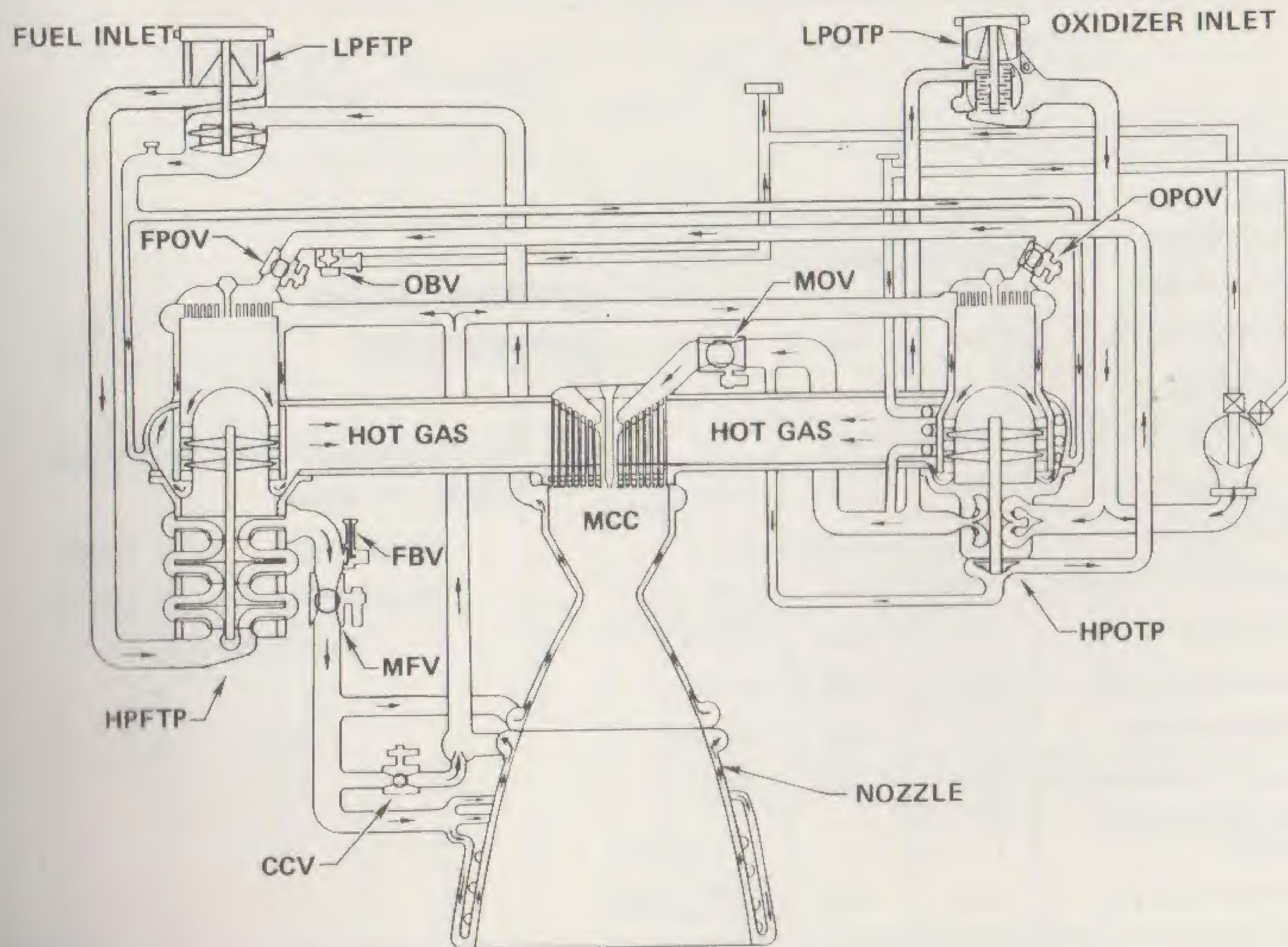
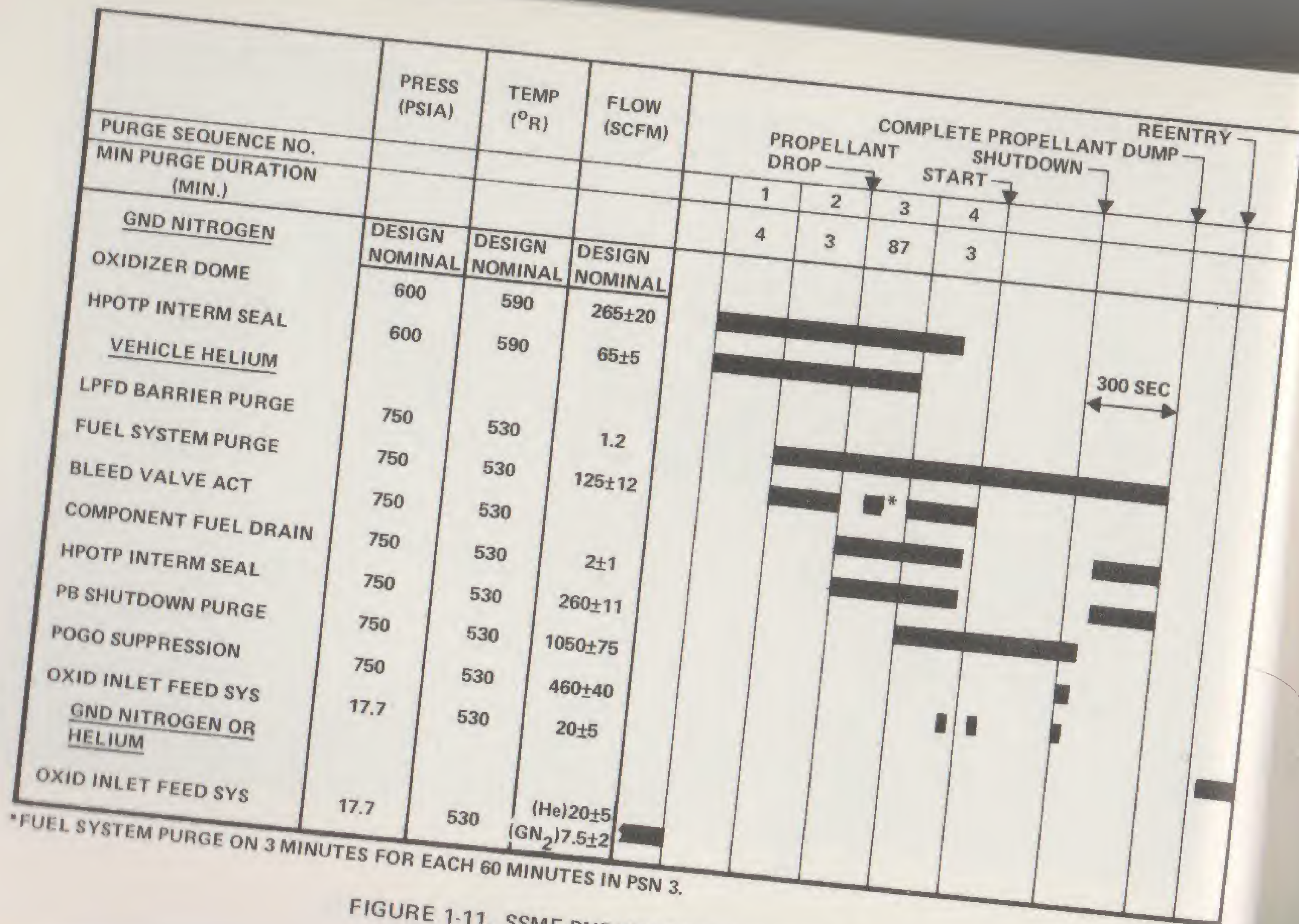


FIGURE 1-10. SSME PROPELLANT FLOW SCHEMATIC



*FUEL SYSTEM PURGE ON 3 MINUTES FOR EACH 60 MINUTES IN PSN 3.

FIGURE 1-11. SSME PNEUMATIC REQUIREMENTS

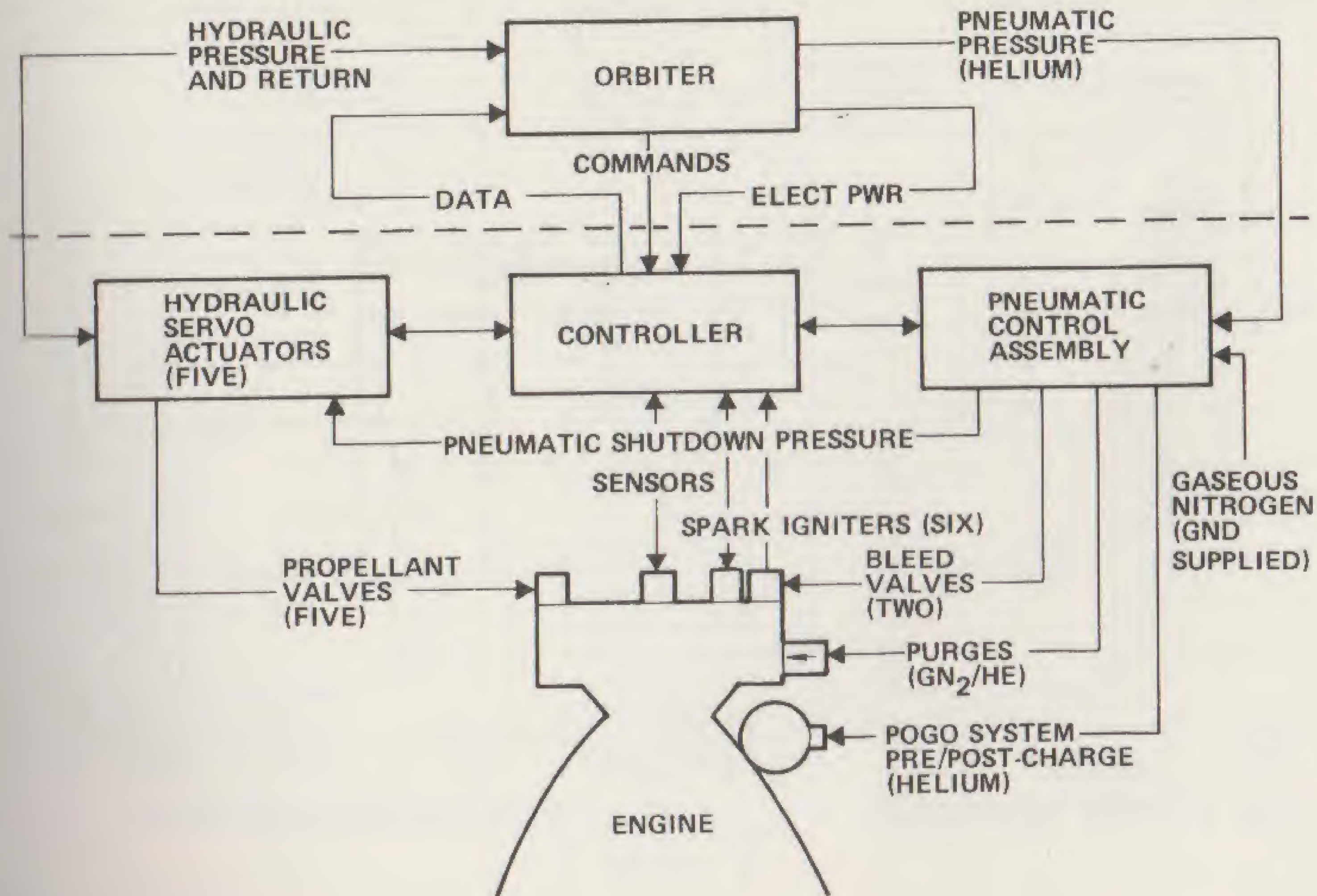


FIGURE 1-12. SSME CONTROL SYSTEM

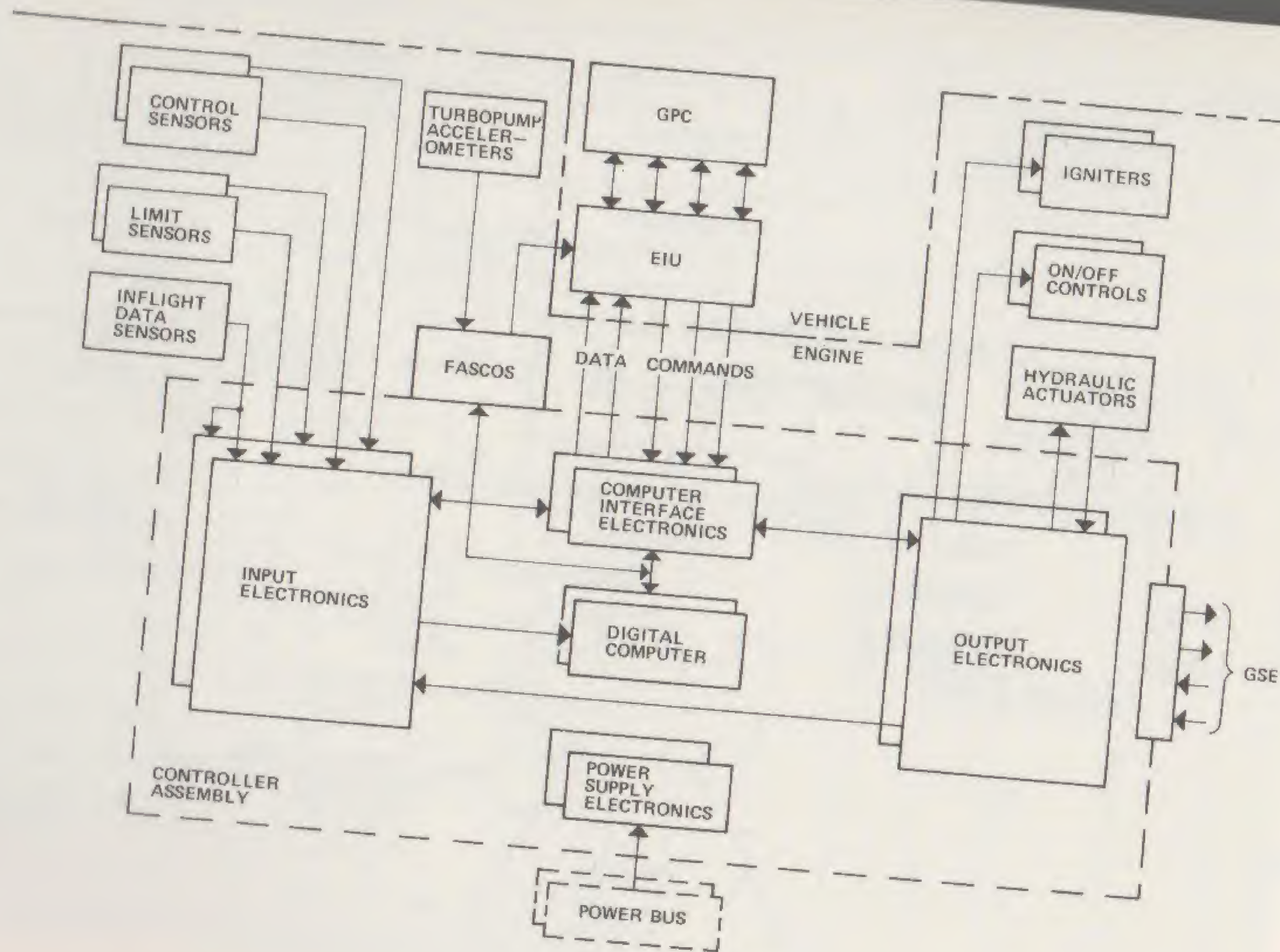
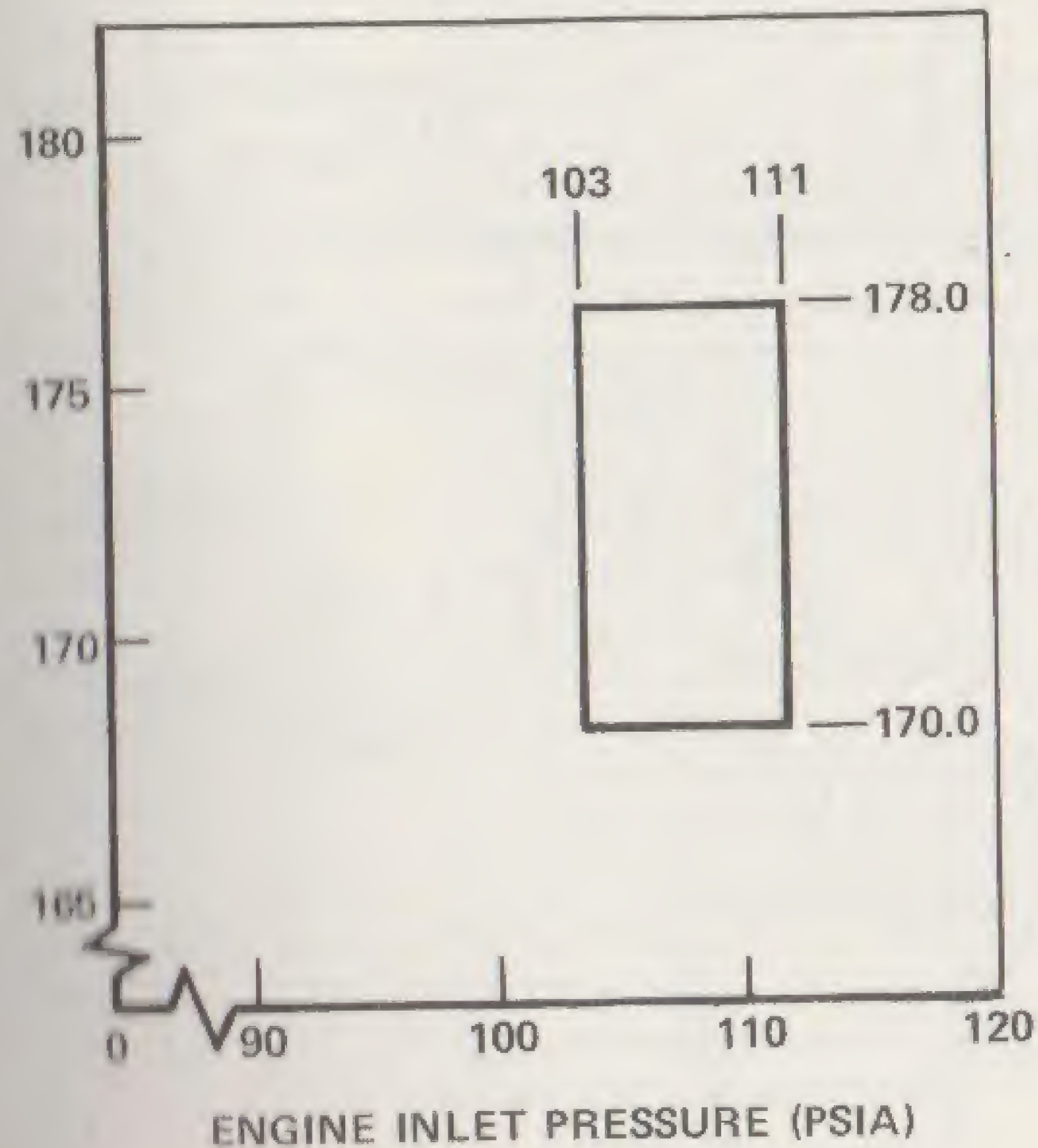


FIGURE 1-13. CONTROLLER ORGANIZATION

OXIDIZER



FUEL

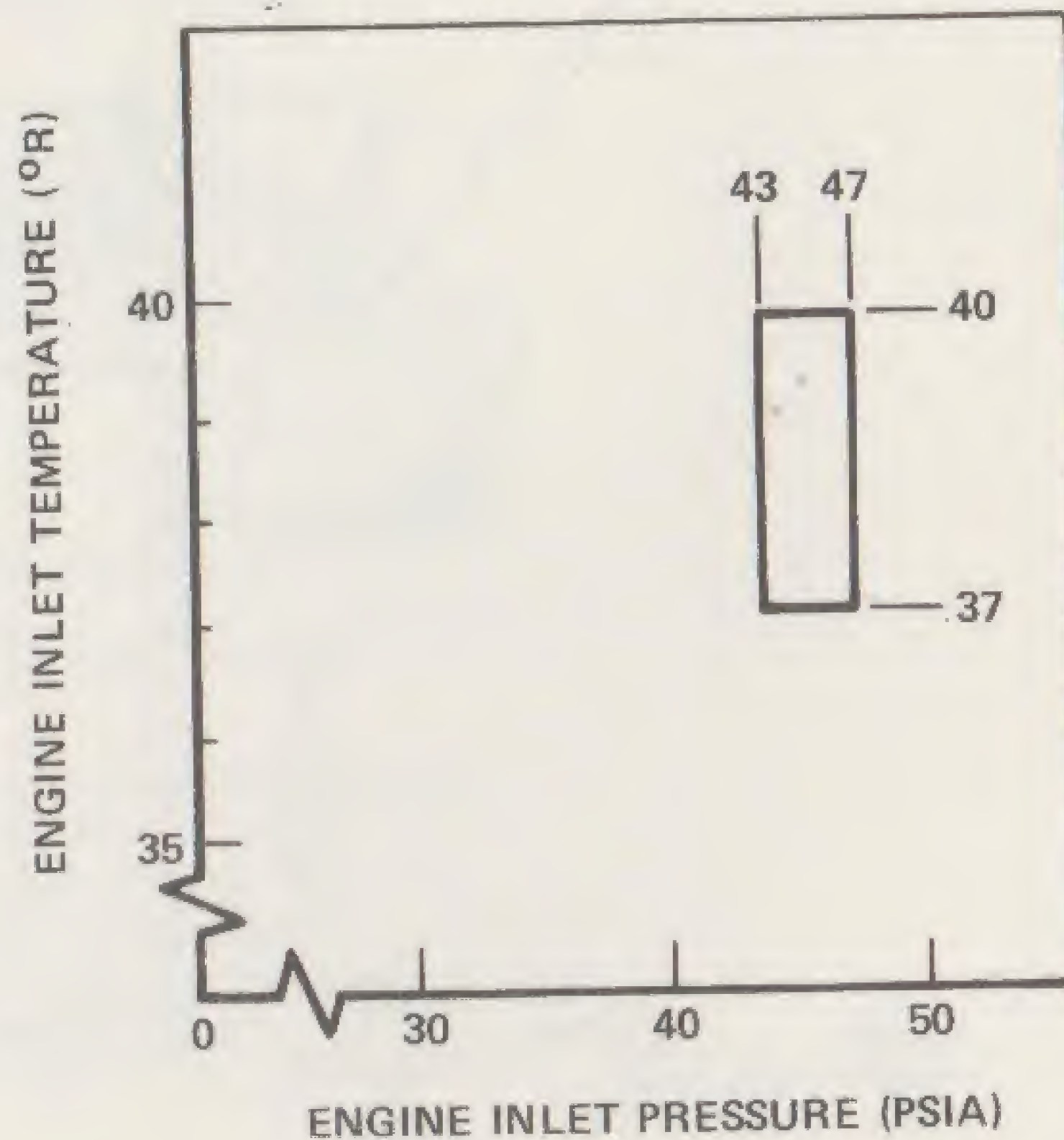


FIGURE 1-14. PRESTART PROPELLANT CONDITIONS

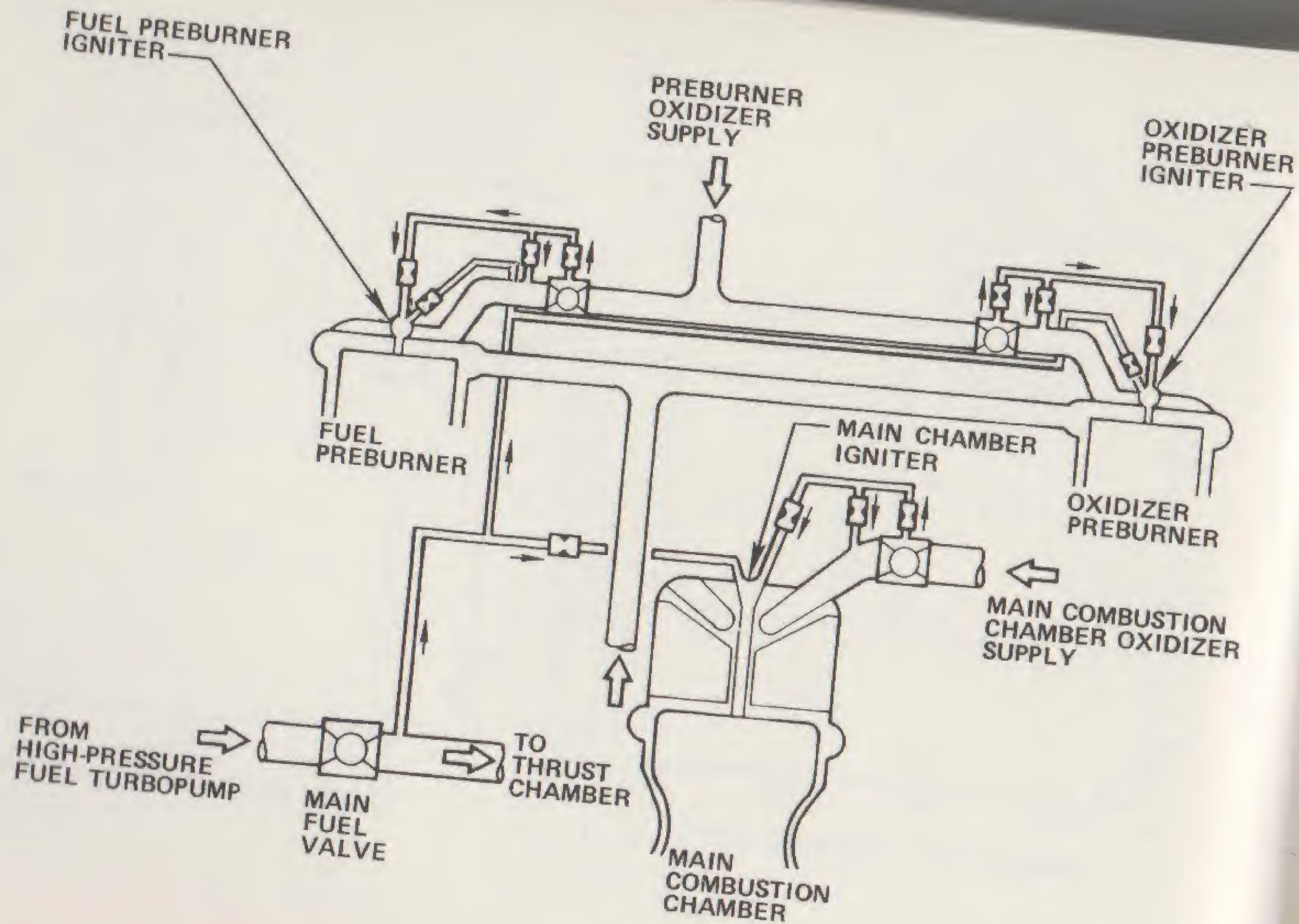


FIGURE 1-15. IGNITION SYSTEM SCHEMATIC

HR	MIN	SEC	
T-46:	00:	00	CALL TO STATIONS – SET COUNTDOWN CLOCK
T-45:	30:	00	ORBITER POWER UP
T-27:	00:	00	SSME PREPS FOR CRYO-LOAD (OMRSD SOOFAO.210)
			● PNEUMATIC COMPONENT CHECKOUT
			● SENSOR/IGNITER CALIBRATION/CHECKOUT
			● LOAD FLIGHT SOFTWARE
			● PURGE SEQ. NO. 3 CHECKOUT (5 SECS MIN)
T-06:	30:	00	INITIATE SSME PURGING (PSN 1, 2, AND 3)
T-06:	00:	00	START LH ₂ /LOX CHILLDOWN
T-03:	15:	00	COMPLETE LH ₂ TANKING
T-03:	05:	00	COMPLETE LOX TANKING
T-00:	09:	00	START GROUND LAUNCH SEQUENCER (GLS)
T-00:	05:	00	START APU
T-00:	04:	30	DEACTIVATE SSME MFV HEATERS
T-00:	04:	00	INITIATE PSN 4
T-00:	02:	55	INITIATE LO ₂ PRE-PRESSURIZATION/GN ₂ PURGE OFF
T-00:	01:	57	INITIATE LH ₂ PRE-PRESSURIZATION
T-00:	00:	31	START REDUNDANT SET AUTO SEQUENCE
T-00:	00:	10	GLS GO-FOR-SSME-START (START ENABLE)
T-00:	00:	06.6	SSME START CMD (ENGINES 3, 2, 1 AT 120 MS INTERVALS)
T-00:	00:	03	SSME MAINSTAGE (\geq 90% THRUST)
T-00:	00:	00	SRB IGNITION/LIFTOFF

FIGURE 1-16. SSME LAUNCH COUNTDOWN HIGHLIGHTS (TYPICAL)

SSME OPERATIONAL PHASES/MODES

- CHECKOUT PHASE
 - STANDBY MODE
 - COMPONENT CHECKOUT MODE
- START PREPARATION PHASE
 - PURGE SEQUENCE NO. 1 MODE
 - PURGE SEQUENCE NO. 2 MODE
 - PURGE SEQUENCE NO. 3 MODE
 - PURGE SEQUENCE NO. 4 MODE
 - ENGINE READY MODE
- START PHASE
 - START INITIATION MODE
 - THRUST BUILDUP MODE
 - ELECTRICAL LOCKUP
 - HYDRAULIC LOCKUP
 - FIXED DENSITY
- MAINSTAGE PHASE
 - NORMAL CONTROL MODE
 - ELECTRICAL LOCKUP MODE
 - HYDRAULIC LOCKUP MODE
 - THRUST LIMITING
 - FIXED DENSITY
- SHUTDOWN PHASE
 - THROTTLE TO ZERO THRUST MODE
 - PROPELLANT VALVES CLOSED MODE
 - FAIL-SAFE PNEUMATIC MODE
- POST-SHUTDOWN PHASE
 - STANDBY MODE
 - TERMINATE SEQUENCE MODE
 - OXIDIZER DUMP MODE

SSME CHECKOUT PHASE MODES

- CHECKOUT PHASE: CONTROLLER OPERATIONAL PROGRAM IS INITIATED TO BEGIN ACTIVE CONTROL, MONITORING, OR CHECKOUT.
 - STANDBY MODE: A WAITING MODE DURING WHICH ACTIVE CONTROL SEQUENCE OPERATIONS ARE NOT IN PROGRESS. MONITORING FUNCTIONS THAT DO NOT AFFECT ENGINE HARDWARE COMPONENT STATUS ARE CONTINUALLY ACTIVE. SUCH FUNCTIONS INCLUDE PROCESSING OF VEHICLE COMMANDS, STATUS UPDATE, AND CONTROLLER SELF-TEST. DURING CHECKOUT PHASE, DATA AND INSTRUCTIONS CAN BE LOADED INTO COMPUTER MEMORY. THIS PERMITS UPDATING OF SOFTWARE PROGRAM AND DATA AS NECESSARY TO PROCEED WITH ENGINE FIRING OPERATIONS OR CHECKOUT OPERATIONS.
 - COMPONENT CHECKOUT MODE: A CHECKOUT OR ENGINE LEAK TEST IS BEING PERFORMED ON AN INDIVIDUAL ENGINE SYSTEM COMPONENT USING OVERLAY MODULES.
 - SENSOR CALIBRATION AND CHECKOUT
 - PNEUMATIC CHECKOUT
 - HYDRAULIC ACTUATOR CHECKOUT
 - REDUNDANCY VERIFICATION I & II
 - FLIGHT READINESS TEST (FRT AND FRT-2)

SSME START PREPARATION PHASE MODES

- **START PREPARATION PHASE:** SYSTEM PURGES AND PROPELLANT CONDITIONING ARE PERFORMED IN PREPARATION FOR ENGINE START.
- **PURGE SEQUENCE NO. 1 MODE:** FIRST PURGE SEQUENCE OF START PREPARATION PHASE IS IN PROGRESS. FUNCTIONS INCLUDE COMMANDING PROPELLANT VALVES CLOSED. DURING THIS SEQUENCE, FACILITY INITIATES OXIDIZER SYSTEM AND HPOTP INTERMEDIATE SEAL GASEOUS NITROGEN PURGES.
- **PURGE SEQUENCE NO. 2 MODE:** SECOND PURGE SEQUENCE OF START PREPARATION IS IN PROGRESS. FUNCTIONS INCLUDE FUEL SYSTEM PURGE OPERATION AND CONTINUATION OF PURGES INITIATED IN PURGE SEQUENCE NO. 1.
- **PURGE SEQUENCE NO. 3 MODE:** THIRD PURGE SEQUENCE OF START PREPARATION IS IN PROGRESS. FUNCTIONS INCLUDE PROPELLANT RECIRCULATION (BLEED VALVE OPERATION), ACTUATOR EXERCISE SEQUENCE, AND DISCONTINUANCE OF FUEL SYSTEM PURGE. (NOTE: DURING PURGE SEQUENCE NO. 3, FUEL SYSTEM PURGE WILL BE REINSTATED FOR 3 MINUTES EACH 60-MINUTE PERIOD.)
- **PURGE SEQUENCE NO. 4 MODE:** FOURTH PURGE SEQUENCE OF START PREPARATION IS IN PROGRESS. FUNCTIONS INCLUDE FUEL SYSTEM AND HPOTP INTERMEDIATE SEAL HELIUM PURGES. ALL FAIL-SAFE SERVO-SWITCHES ARE ENERGIZED.
- **ENGINE READY MODE:** READY STAGE OF START PREPARATION IN WHICH PROPER ENGINE CONDITIONS FOR START HAVE BEEN ATTAINED AND OTHER CRITERIA FOR START HAVE BEEN SATISFIED. FUNCTIONS INCLUDE A CONTINUATION OF PURGE SEQUENCE NO. 4 FUNCTION.

PURGE SEQUENCE NO. 1 (NOMINAL DURATION: 4 MINUTES)

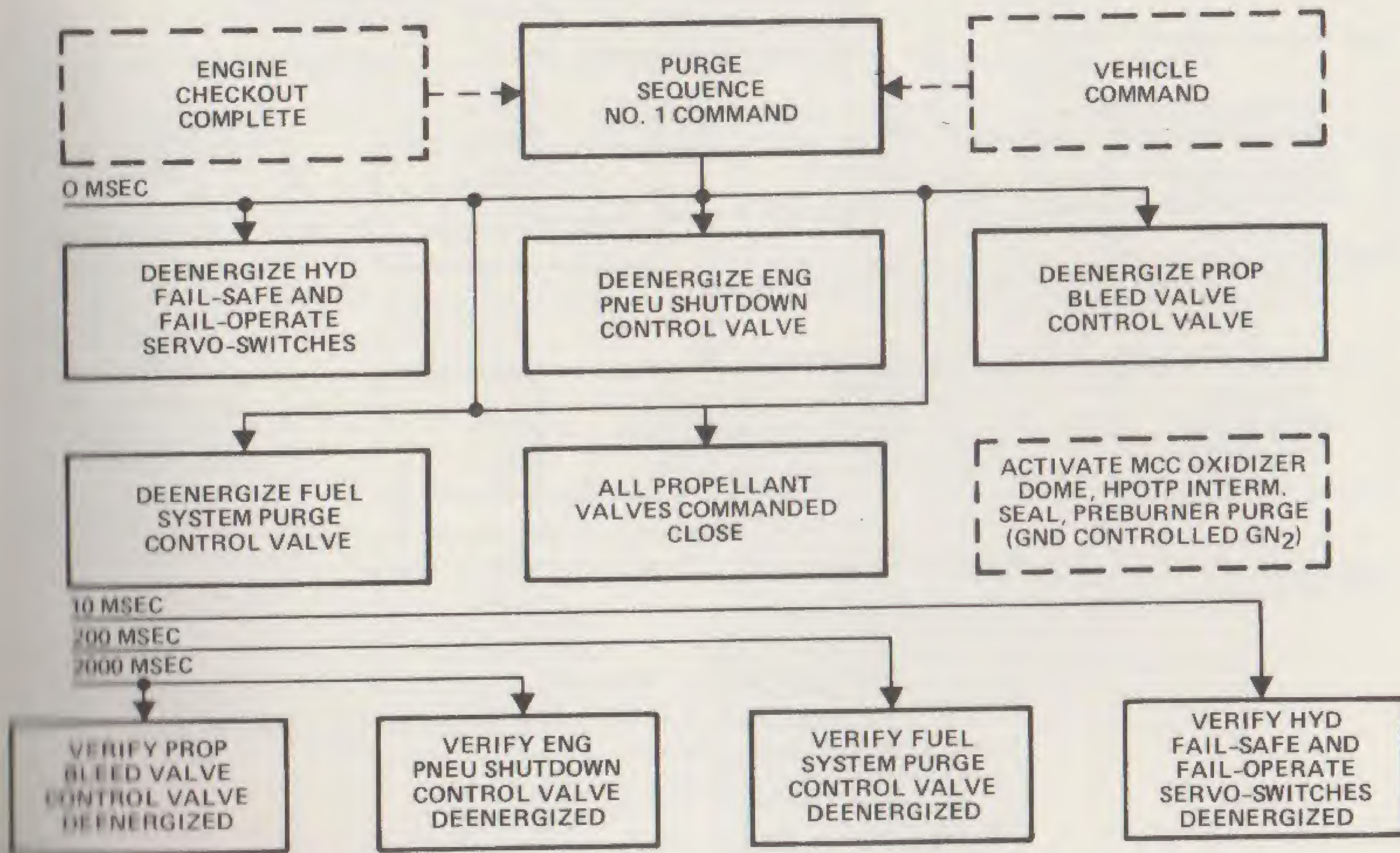


FIGURE 1-17. SSME OPERATIONAL PHASE/MODES (SHEET 4 OF 20)

PURGE SEQUENCE NO. 2 (NOMINAL DURATION: 3 MINUTES)

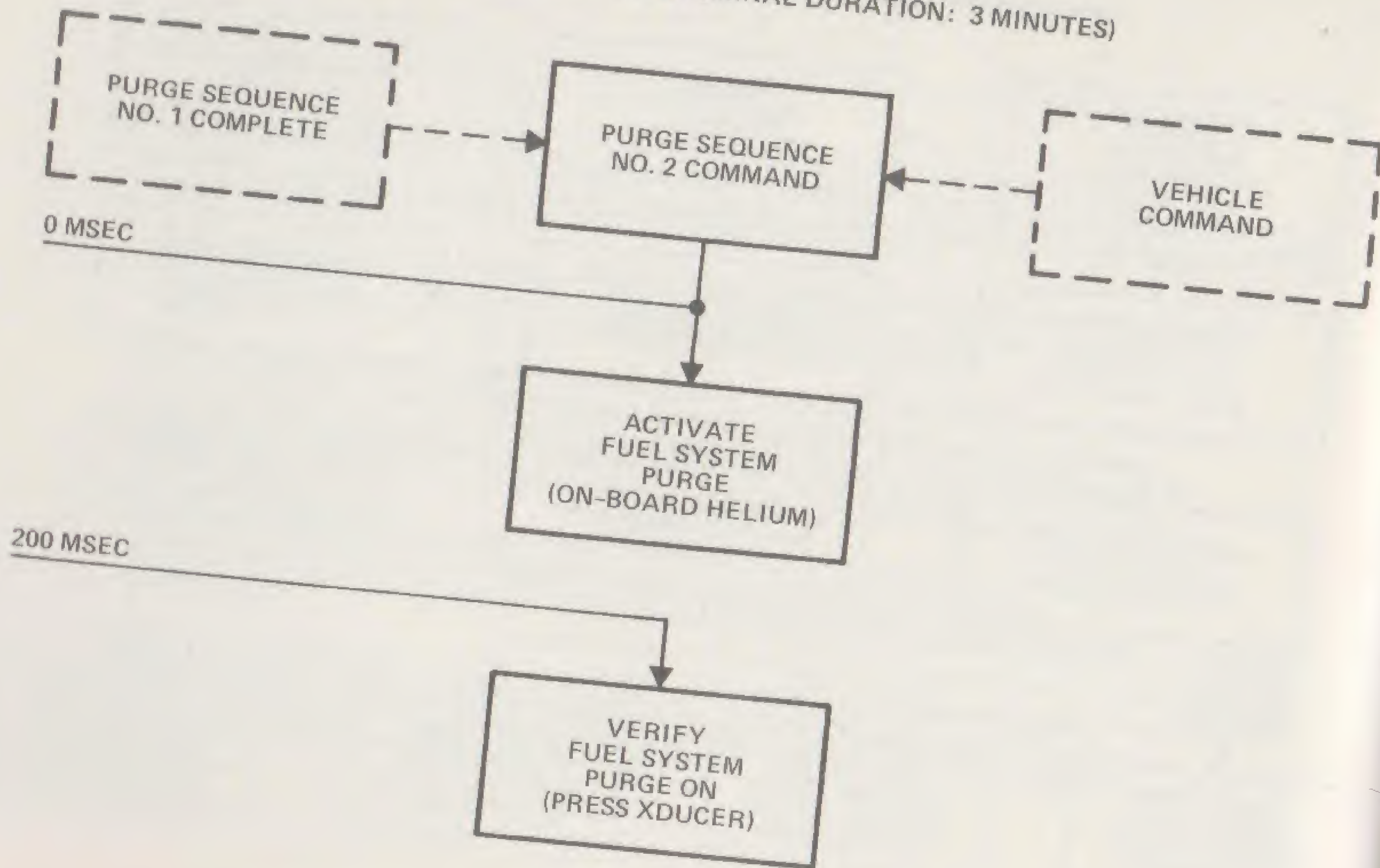


FIGURE 1-17. SSME OPERATIONAL PHASE/MODES (SHEET 5 OF 20)

PURGE SEQUENCE NO. 3 (NOMINAL DURATION: 6-8 HOURS)

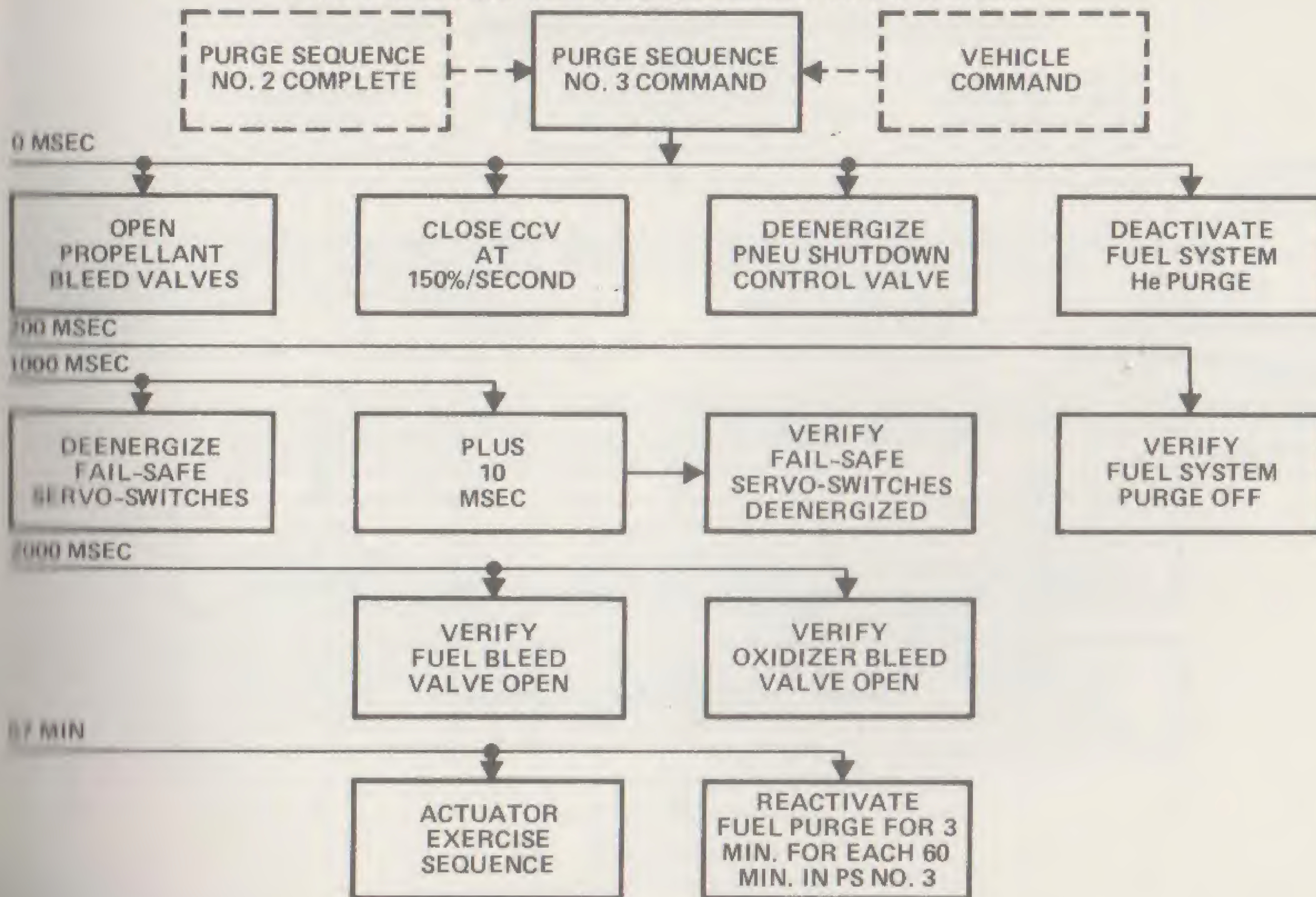


FIGURE 1-17. SSME OPERATIONAL PHASE/MODES (SHEET 6 OF 20)

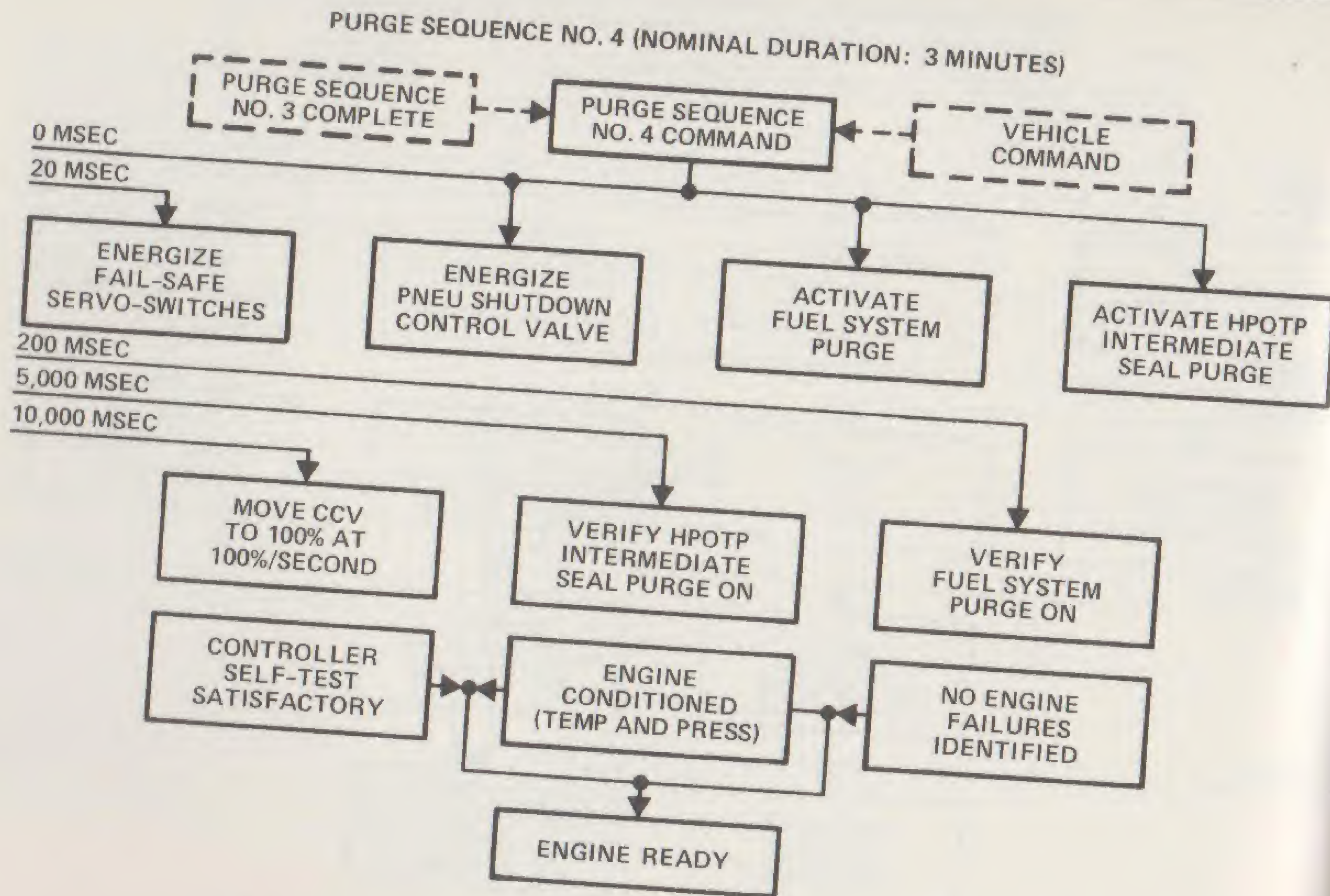


FIGURE 1-17. SSME OPERATIONAL PHASE/MODES (SHEET 7 OF 20)

SSME START PHASE MODES

- **START PHASE:** OPERATIONS FOR ENGINE STARTING AND FIRING ARE IN PROGRESS, BEGINNING WITH SCHEDULED (OPEN-LOOP) OPERATION OF PROPELLANT VALVES.
- **START INITIATION MODE:** INITIAL FUNCTIONS PRIOR TO IGNITION CONFIRMED ARE IN PROGRESS. IGNITERS ENERGIZED AND VERIFIED. THRUST CONTROL LOOP IS CLOSED.
- **THRUST BUILDUP MODE:** IGNITION HAS BEEN DETECTED BY MONITORING MAIN COMBUSTION CHAMBER PRESSURE AND CLOSED-LOOP THRUST BUILDUP SEQUENCING IS IN PROGRESS. MIXTURE RATIO CONTROL LOOP IS CLOSED. POGO SUPPRESSION ACCUMULATOR IS HELIUM PRE-CHARGED FOR 2 SECONDS. MFV, MOV, AND CCV ARE SCHEDULED I/A/W MCC PRESSURE (THRUST).

GROUND LAUNCH SEQUENCER GO FOR SSME START (NOMINAL DURATION: 3.3 SECONDS)

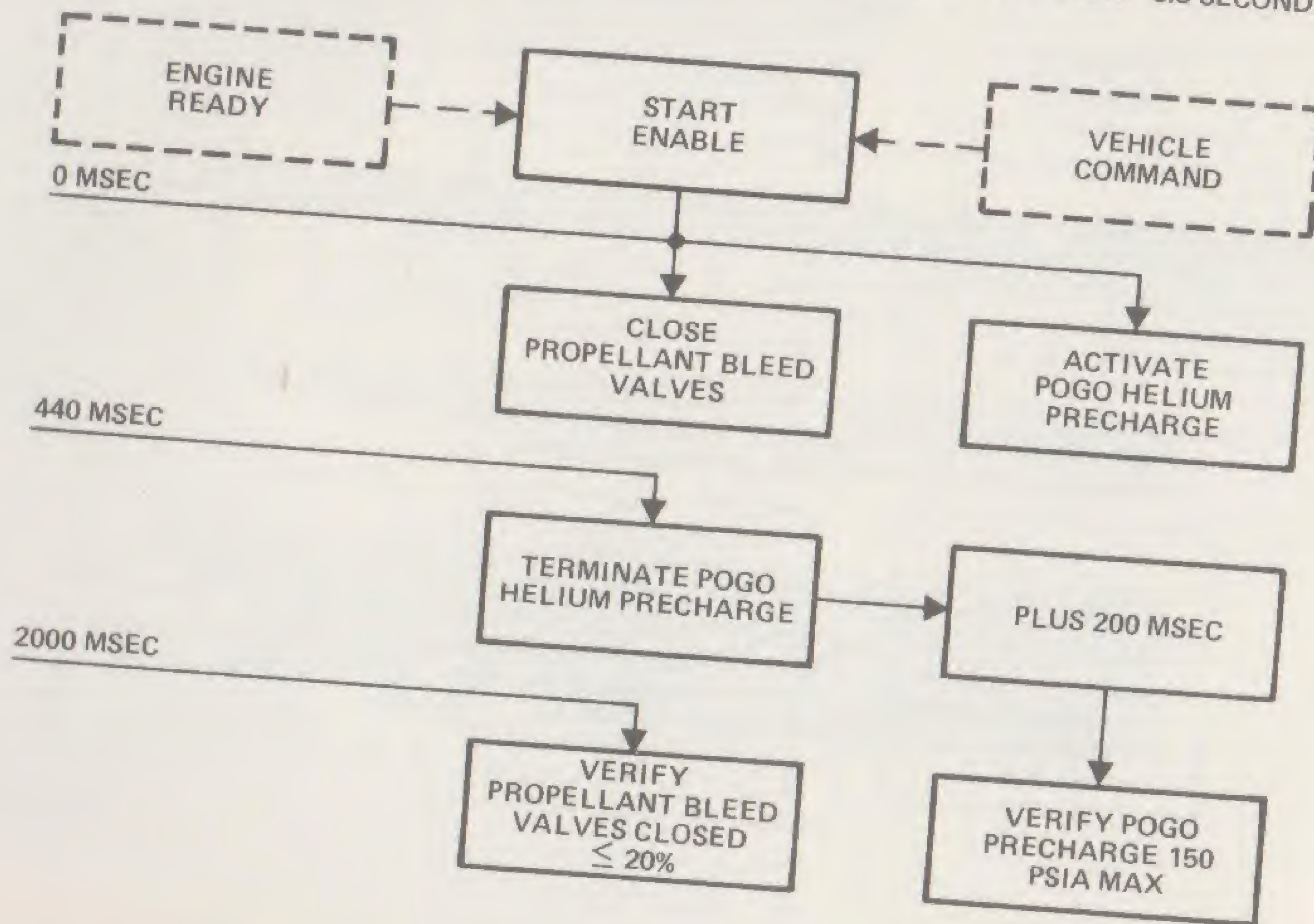


FIGURE 1-17. SSME OPERATIONAL PHASE/MODES (SHEET 9 OF 20)

START INITIATION MODE-FIRST HALF (NOMINAL DURATION: 750 MSEC)

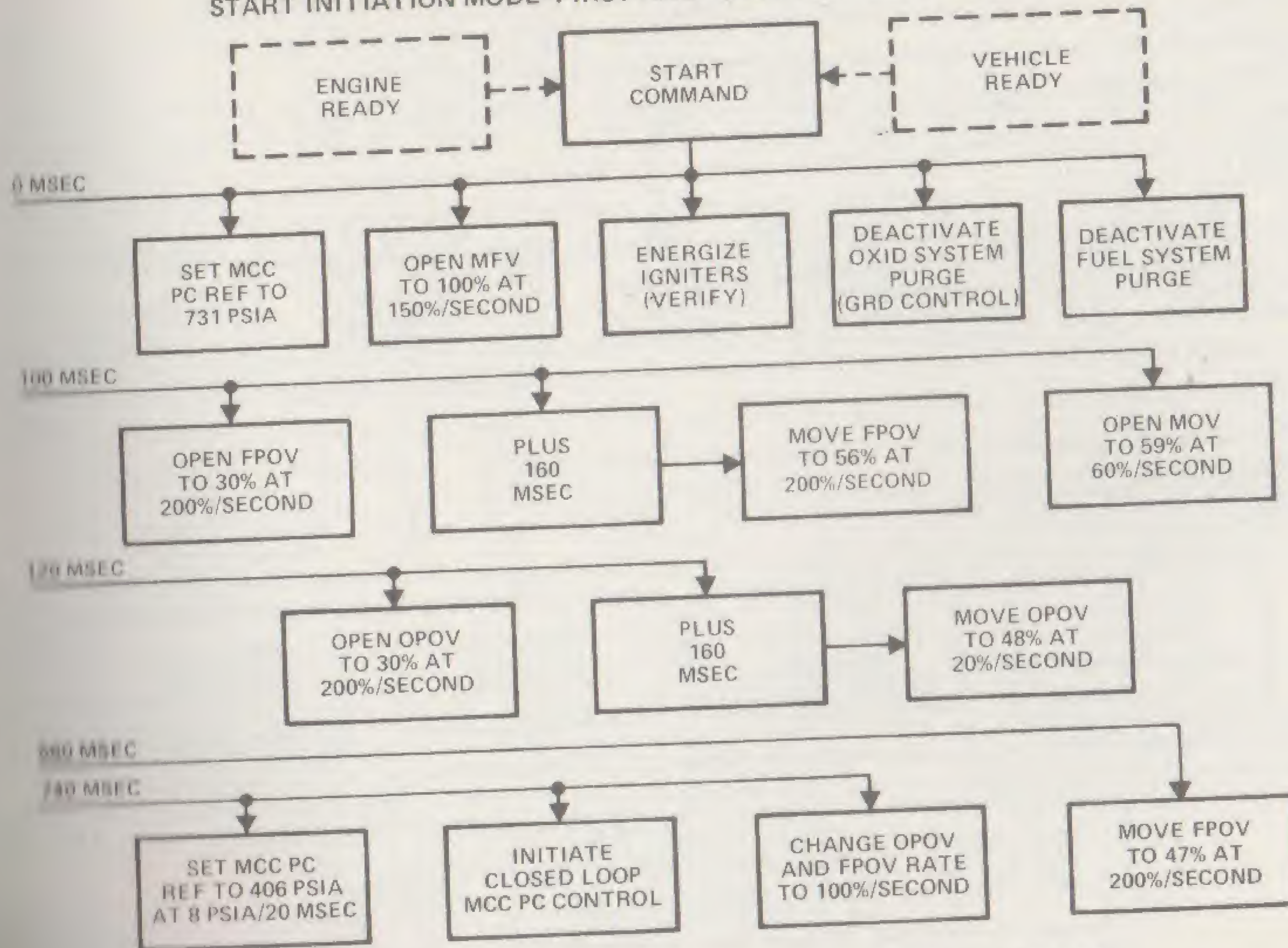


FIGURE 1-17. SSME OPERATIONAL PHASE/MODES (SHEET 10 OF 20)

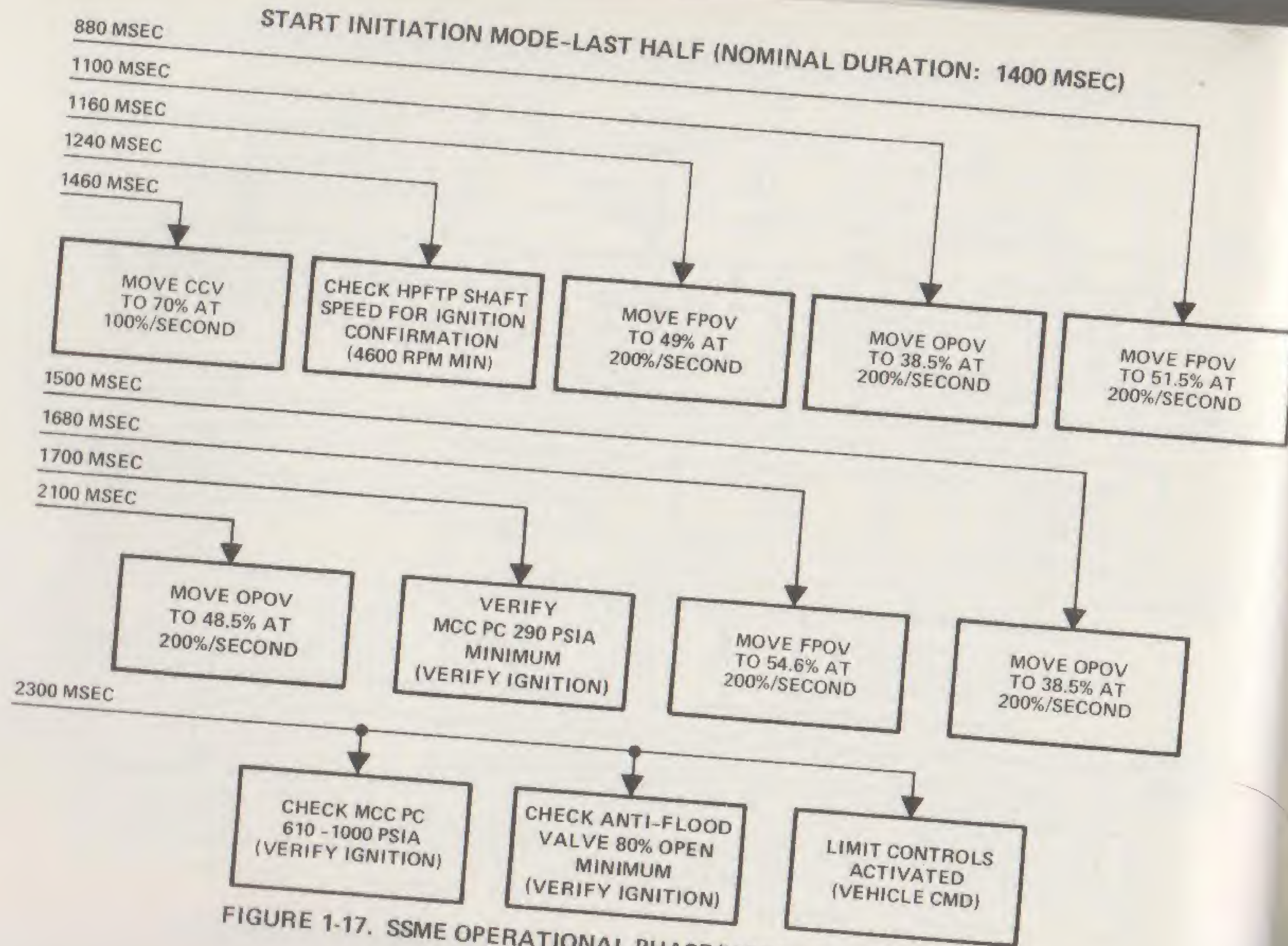


FIGURE 1-17. SSME OPERATIONAL PHASE/MODES (SHEET 11 OF 20)

(THRUST BUILDUP PHASE - NOMINAL DURATION: 2.6 SECONDS)

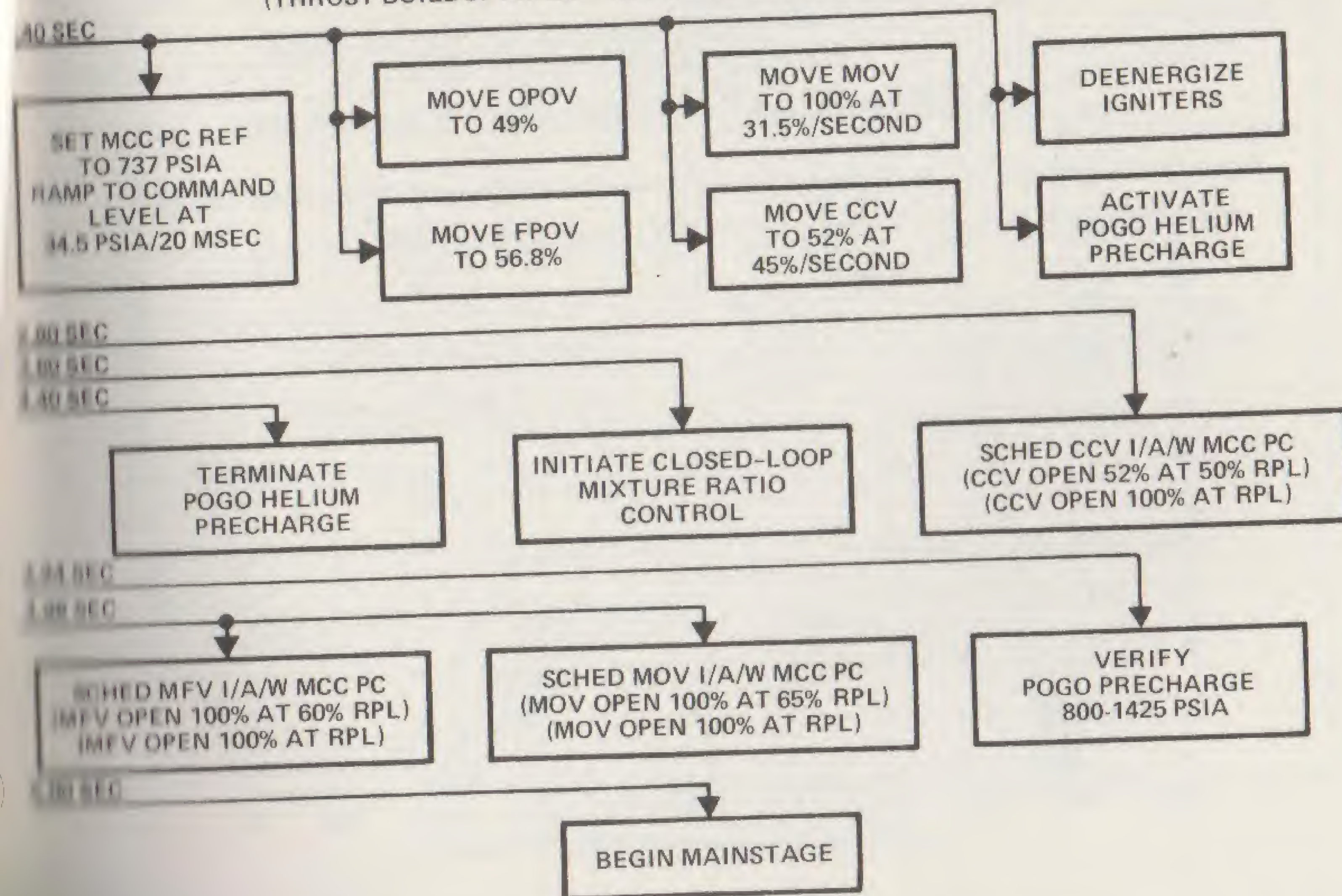


FIGURE 1-17. SSME OPERATIONAL PHASE/MODES (SHEET 12 OF 20)

START
CONTROL
PHASES

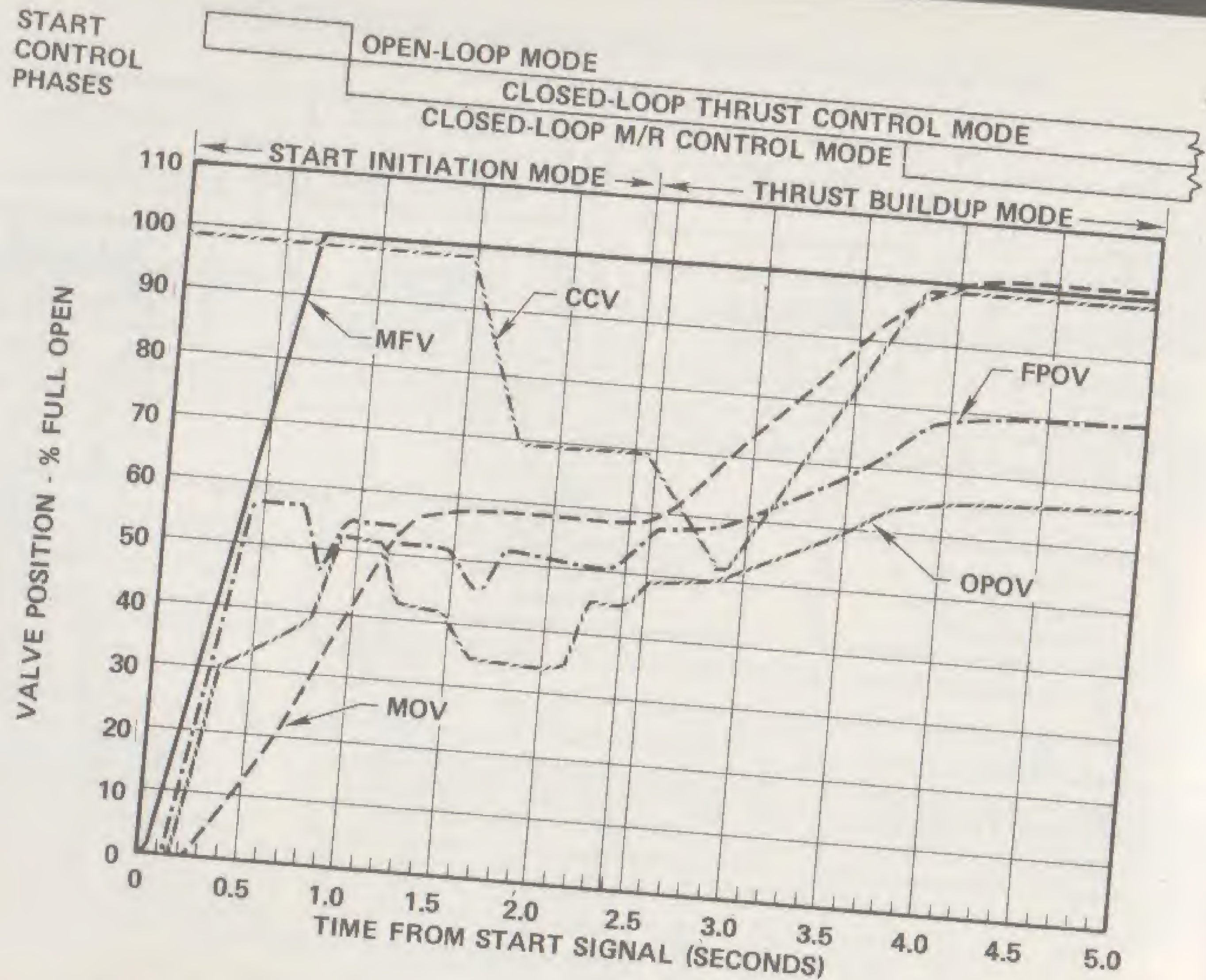


FIGURE 1-17. SSME OPERATIONAL PHASE/MODES (SHEET 13 OF 20)

PERCENT OF RATED POWER LEVEL (K)

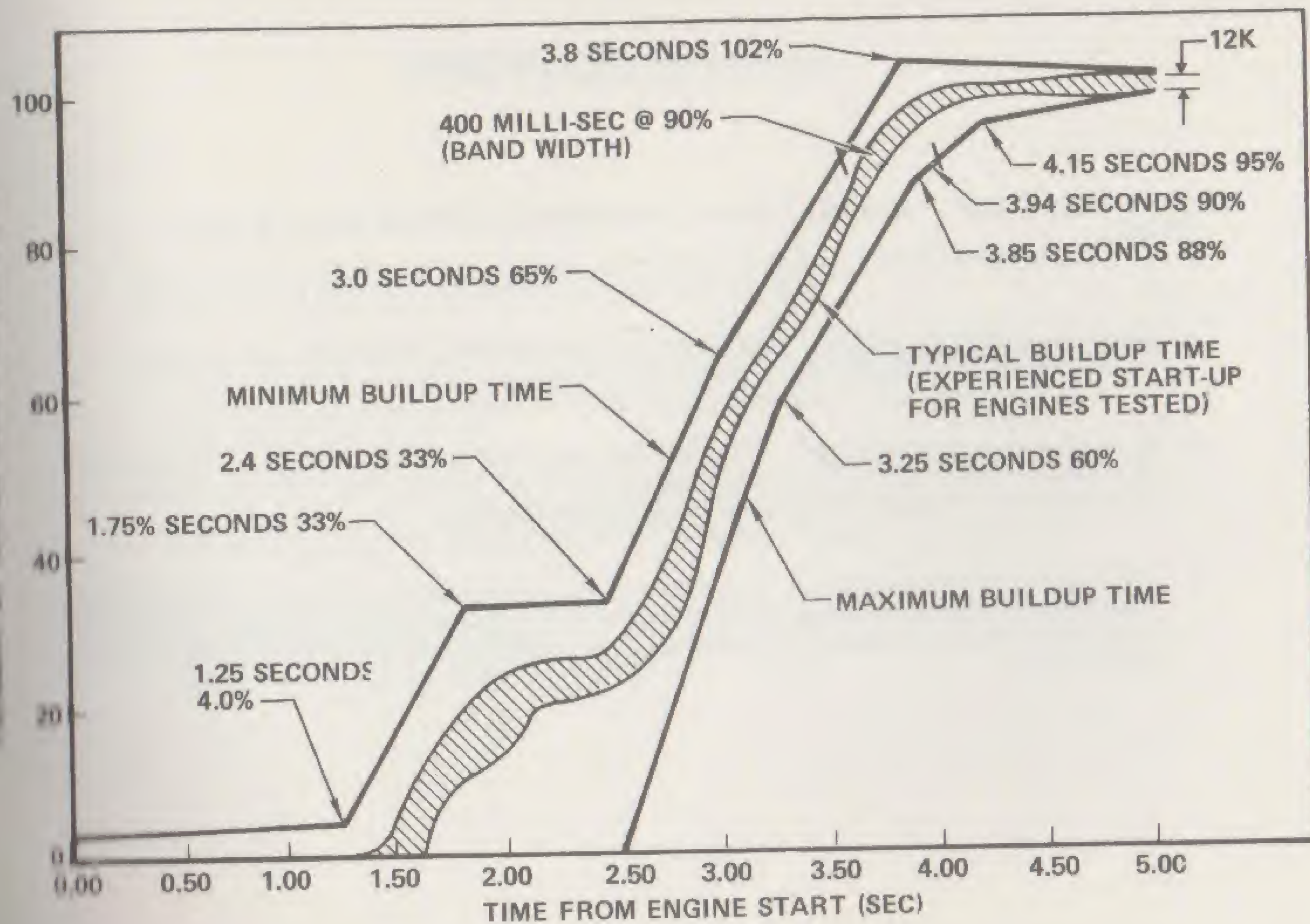


FIGURE 1-17. SSME OPERATIONAL PHASE/MODES (SHEET 14 OF 20)

SSME MAINSTAGE PHASE MODES

- MAINSTAGE PHASE: AUTOMATICALLY ENTERED ON COMPLETION OF START PHASE.
- NORMAL CONTROL MODE: MIXTURE RATIO CONTROL HAS BEEN INITIATED; THRUST CONTROL IS OPERATING NORMALLY.
- ELECTRICAL LOCKUP MODE: ENGINE PROPELLANT VALVES ARE ELECTRICALLY HELD IN A FIXED CONFIGURATION AS EXISTED AT INITIATION OF THIS MODE. ALL CONTROL LOOP COMPUTATIONS ARE SUSPENDED.
- HYDRAULIC LOCKUP MODE: ALL FAIL-SAFE SERVO-SWITCHES ARE DE-ENERGIZED TO HYDRAULICALLY HOLD PROPELLANT VALVES IN A FIXED CONFIGURATION AS EXISTED AT INITIATION OF THIS MODE. ALL CONTROL LOOP COMPUTATIONS ARE SUSPENDED.

SSME SHUTDOWN PHASE MODES

- SHUTDOWN PHASE: OPERATIONS TO REDUCE ENGINE MCC PRESSURE AND DRIVE ALL VALVES TO EFFECT ENGINE SHUTDOWN.
- THROTTLING TO ZERO THRUST MODE: SHUTDOWN IS IN PROGRESS AT A PROGRAMMED SHUTDOWN THRUST REFERENCE LEVEL. HELIUM POST-CHARGE IS ACTIVATED.
- PROPELLANT VALVES CLOSED MODE: THE SHUTDOWN SEQUENCE IS IN STAGE FOLLOWING CLOSURE OF ALL LIQUID PROPELLANT VALVES.
- FAILSAFE PNEUMATIC MODE: THE ENGINE IS IN PNEUMATIC SHUTDOWN MODE DUE TO THE EXISTENCE OF HYDRAULIC LOCKUP OR VARIOUS OTHER SERIOUS ENGINE FAILURES.

PART A (MCC PRESSURE LEVEL TO ZERO)

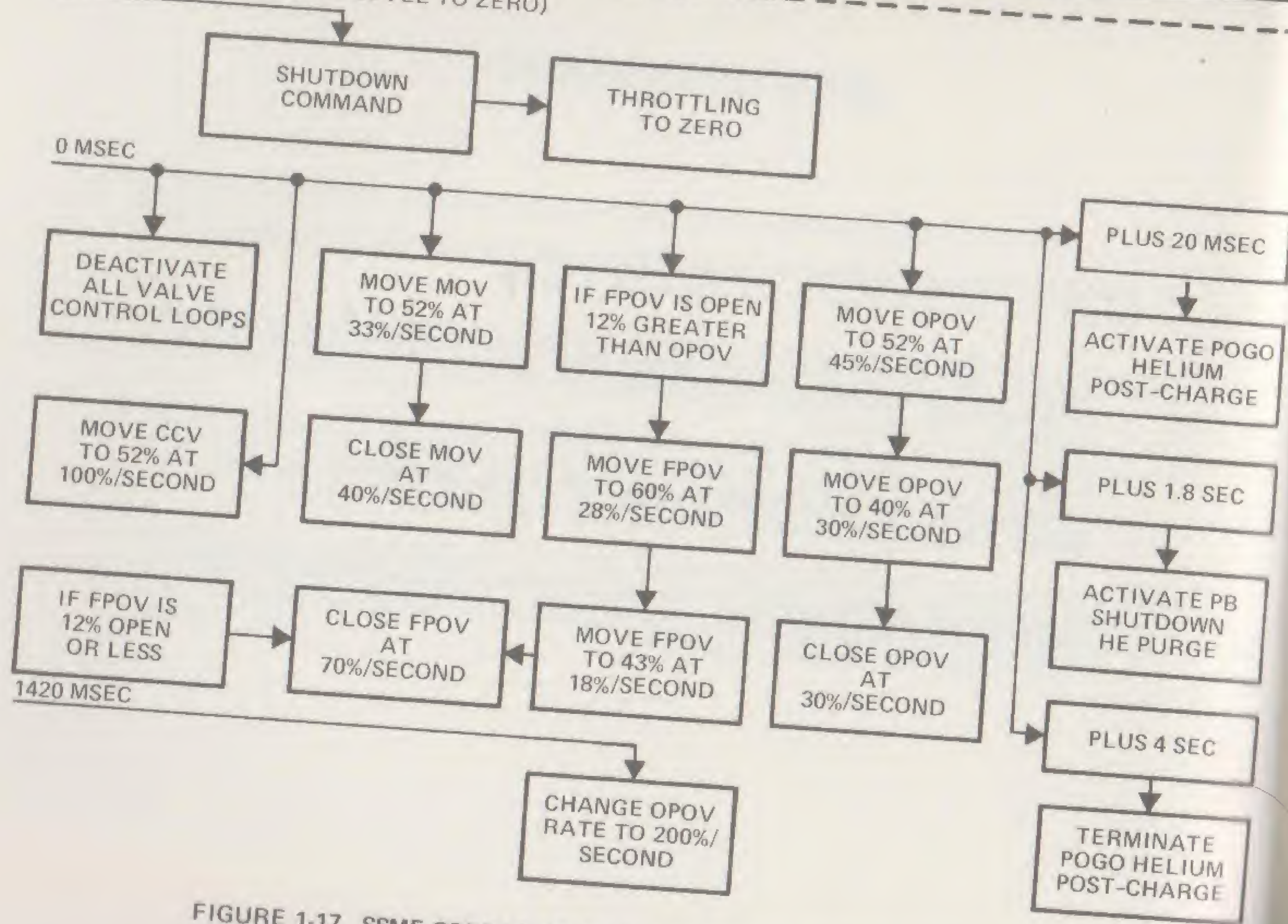
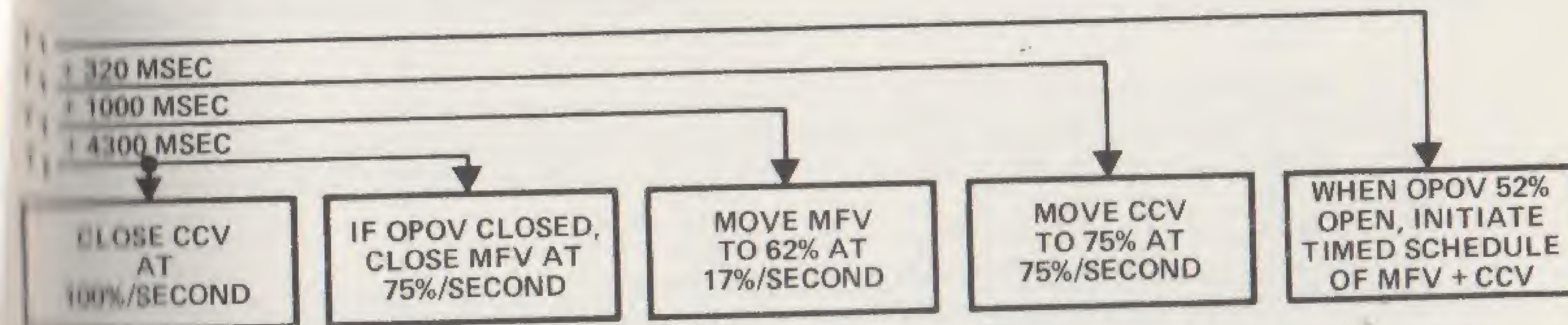


FIGURE 1-17. SSME OPERATIONAL PHASE/MODES (SHEET 17 OF 20)

PART A (MCC PRESSURE LEVEL TO ZERO) (CONTINUED)



PART B (SEQUENCE AFTER PROP VALVES ARE CLOSED)

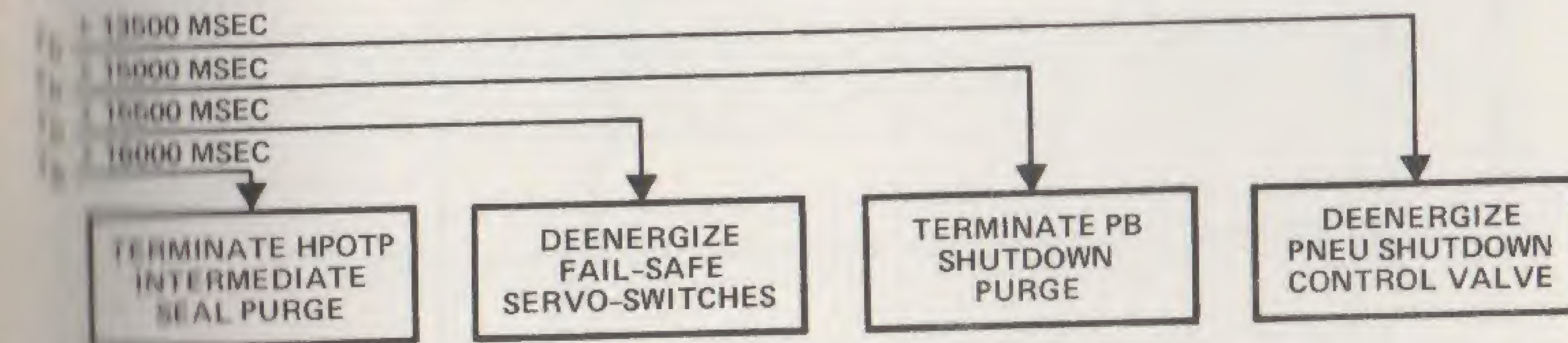


FIGURE 1-17. SSME OPERATIONAL PHASE/MODES (SHEET 18 OF 20)

SHUTDOWN
CONTROL
PHASES

VALVE POSITION - % FULL OPEN

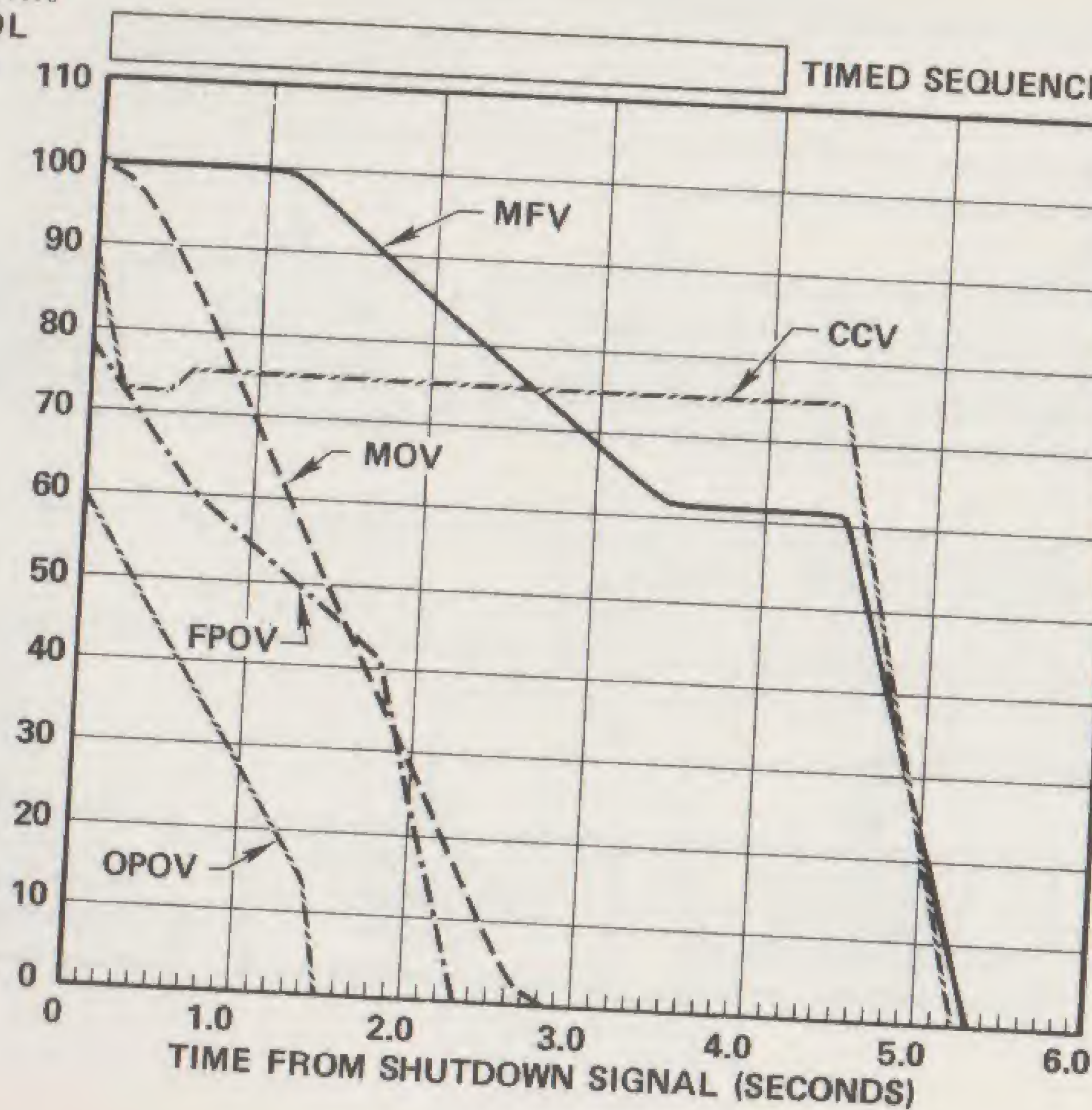


FIGURE 1-17. SSME OPERATIONAL PHASE/MODES (SHEET 19 OF 20)

SSME POST-SHUTDOWN PHASE MODES

- **POST-SHUTDOWN PHASE:** STATE TO WHICH SSME AND MEC REVERT AT COMPLETION OF ENGINE FIRING.
- **STANDBY MODE:** A WAITING MODE OF CONTROLLER OPERATIONS WITH FUNCTIONS IDENTICAL TO THOSE OF STANDBY DURING CHECKOUT. THIS IS NORMAL MODE OF POST-SHUTDOWN ENTERED AFTER COMPLETION OF SHUTDOWN PHASE.
- **TERMINATE SEQUENCE MODE:** TERMINATION OF A PURGE SEQUENCE BY A COMMAND FROM VEHICLE IS IN PROGRESS. ALL PROPELLANT VALVES ARE BEING CLOSED, AND ALL SOLENOID AND FAIL-SAFE SERVO-SWITCHES ARE BEING DE-ENERGIZED.
- **OXIDIZER DUMP MODE:** OXIDIZER DUMP SEQUENCE BEING PERFORMED.

SECTION II

SPACE SHUTTLE MAIN ENGINE (SSME) DESCRIPTION

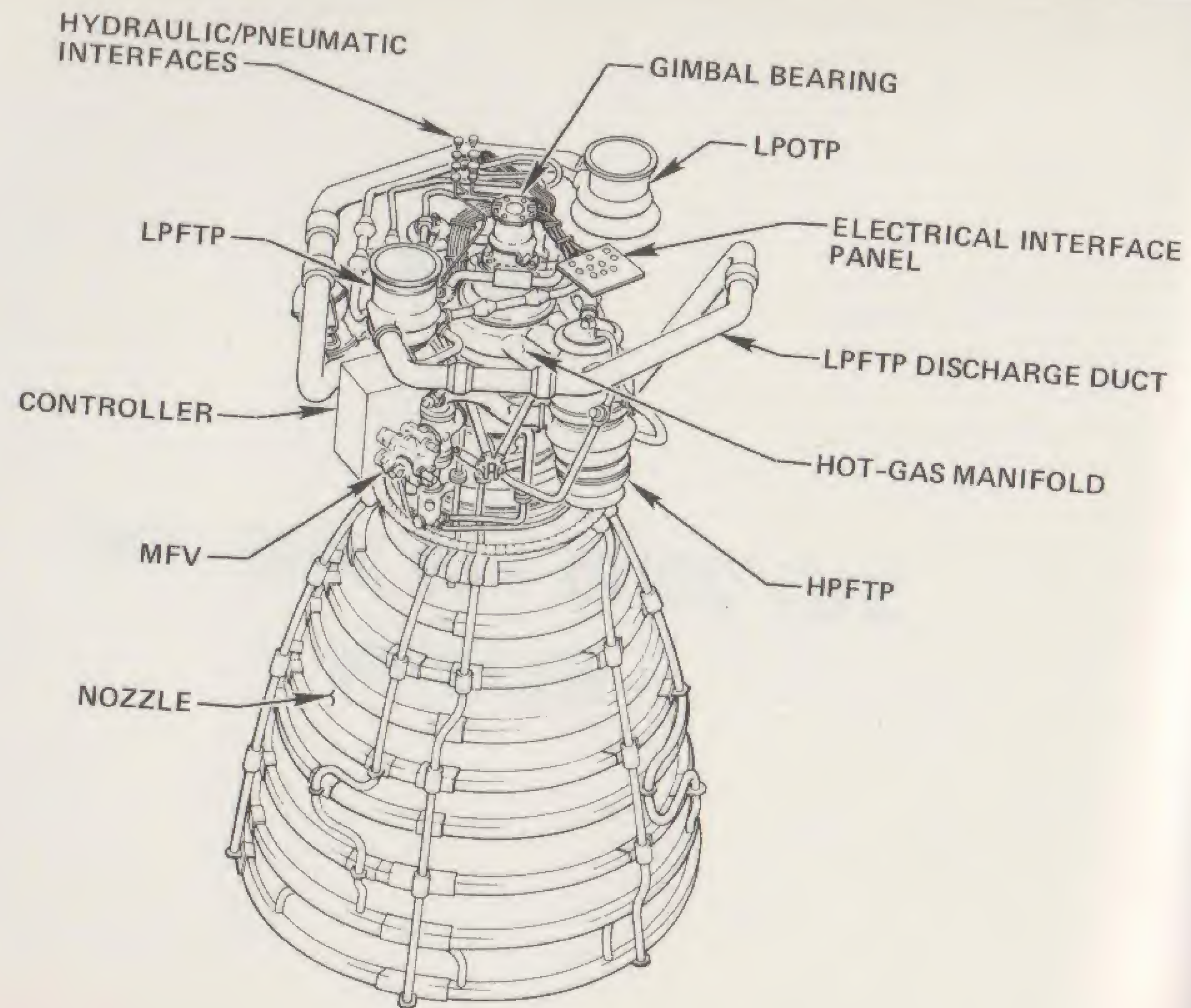


FIGURE 2-1. SPACE SHUTTLE MAIN ENGINE (SHEET 1 OF 2)

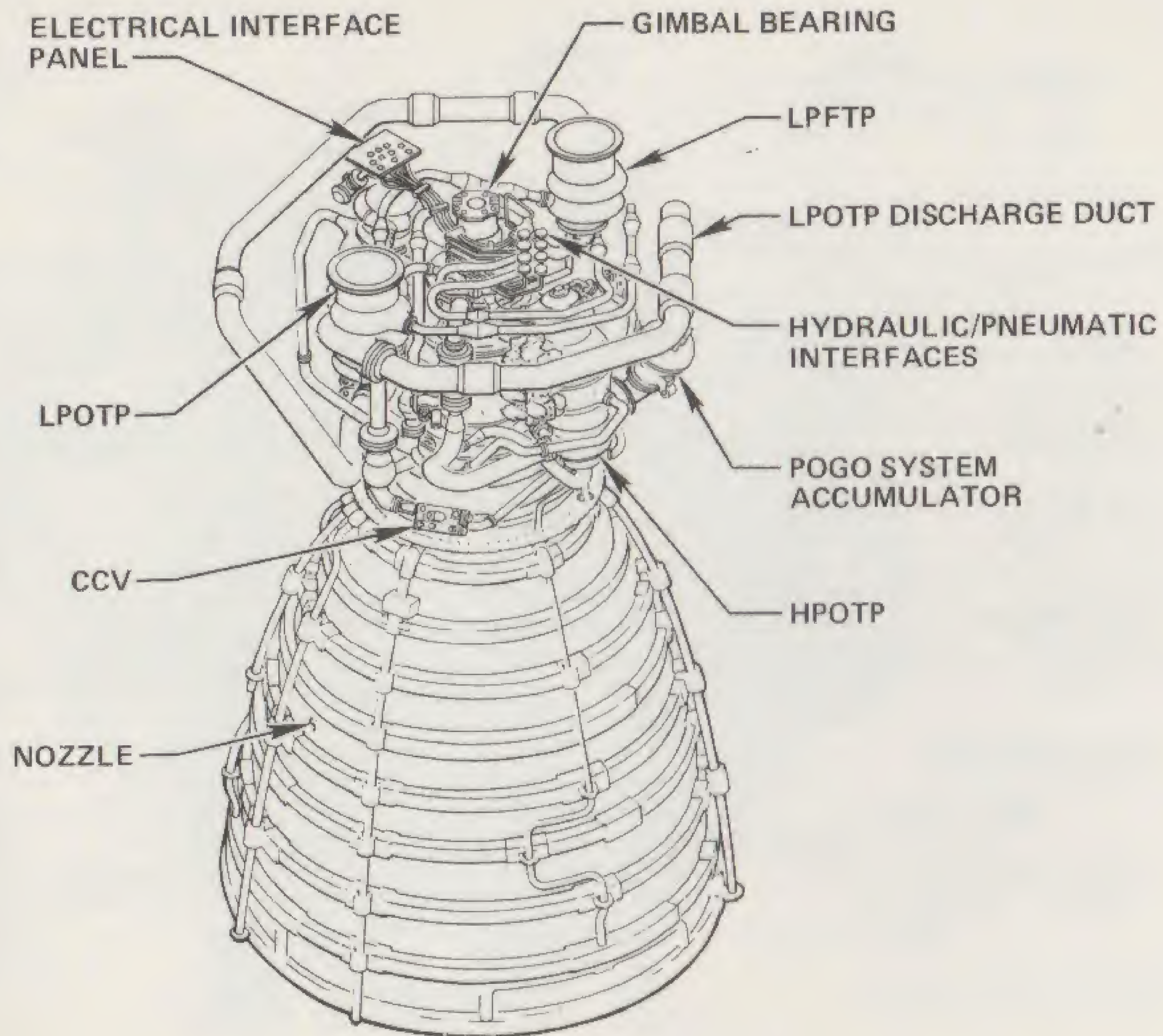


FIGURE 2-1. SPACE SHUTTLE MAIN ENGINE (SHEET 2 OF 2)

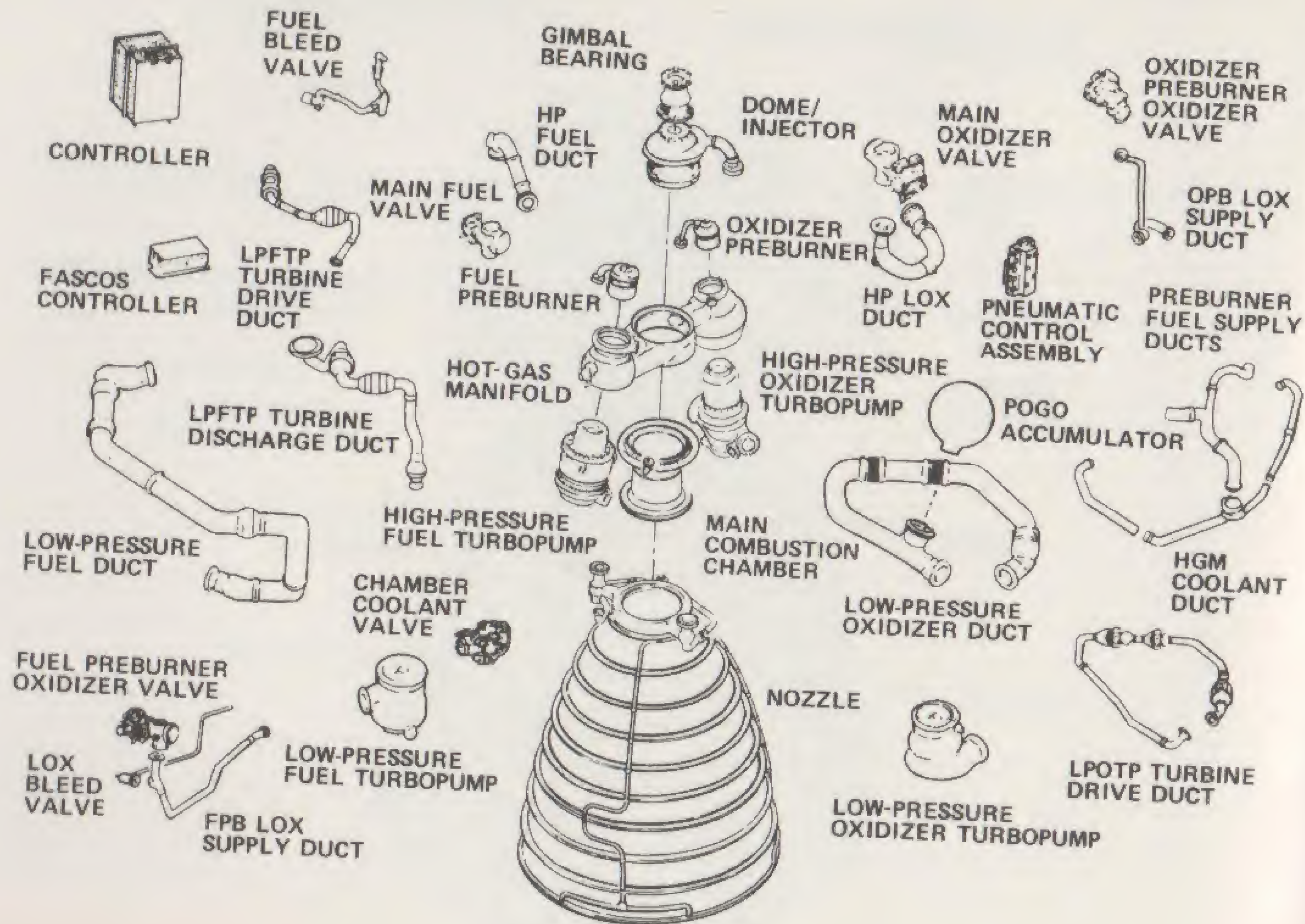


FIGURE 2-2. SSME MAJOR COMPONENTS

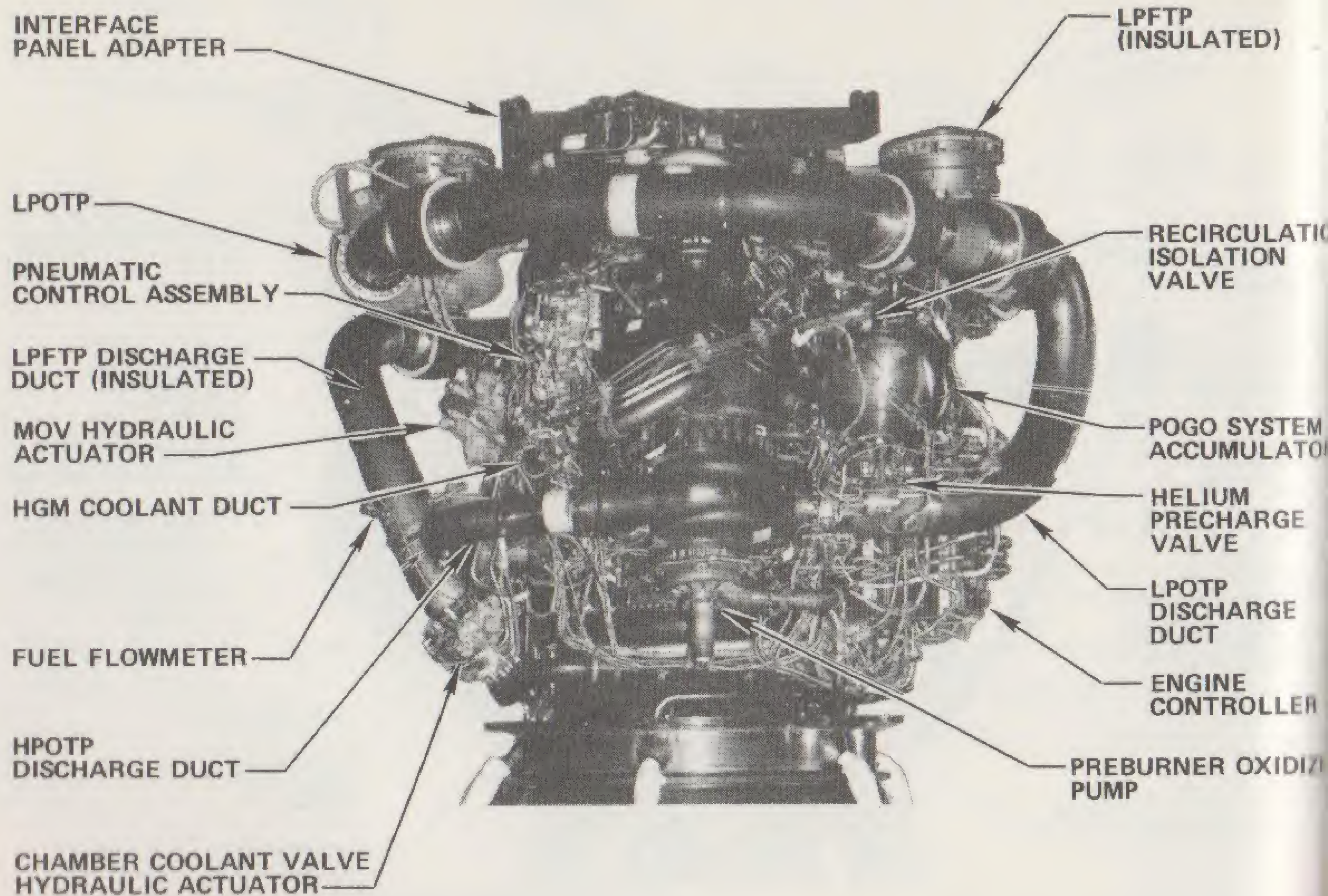


FIGURE 2-3. SSME TYPICAL VIEWS (VIEW 2) (SHEET 2 OF 8)

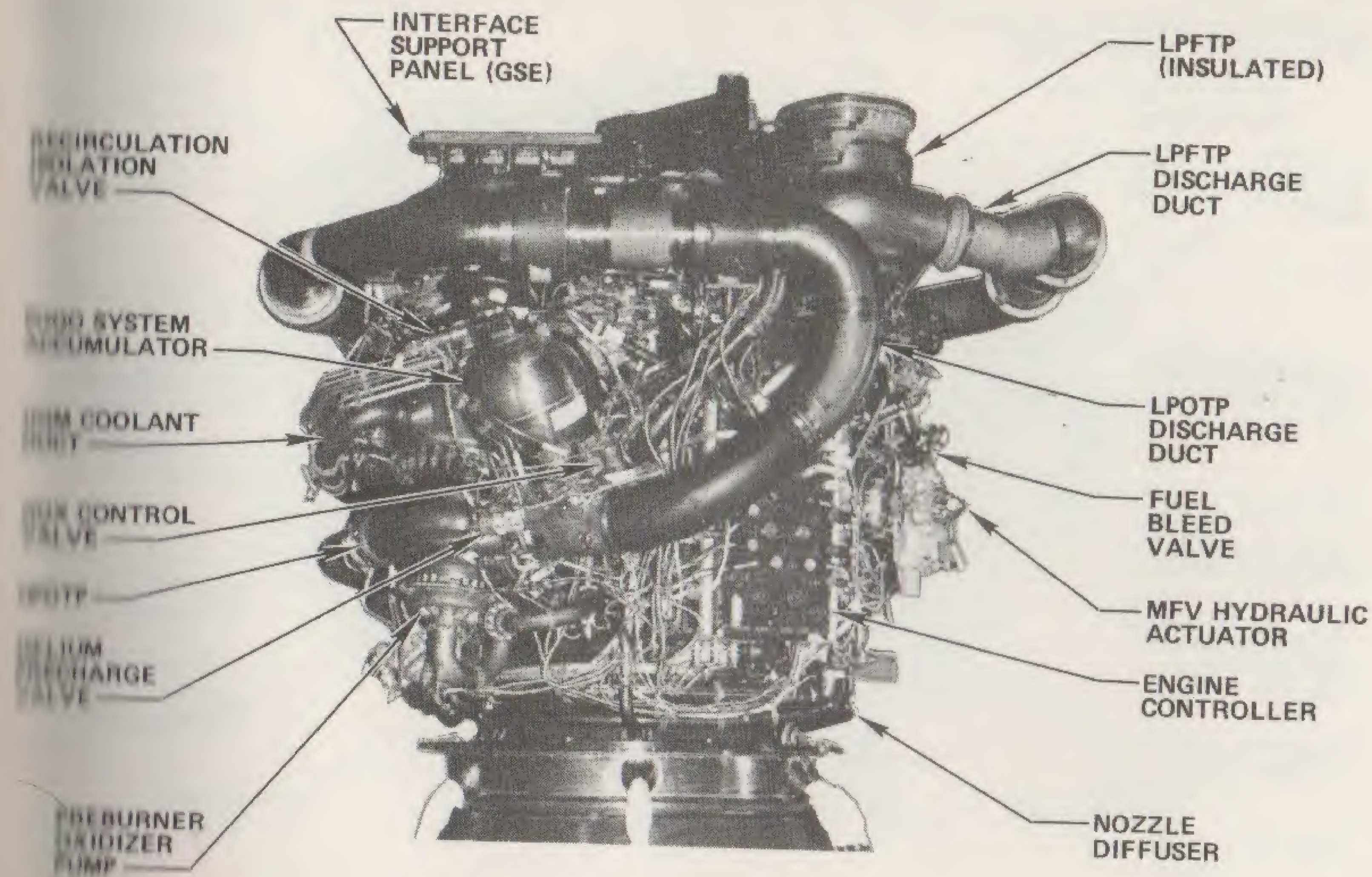


FIGURE 2-3. SSME TYPICAL VIEWS (VIEW 3) (SHEET 3 OF 8)

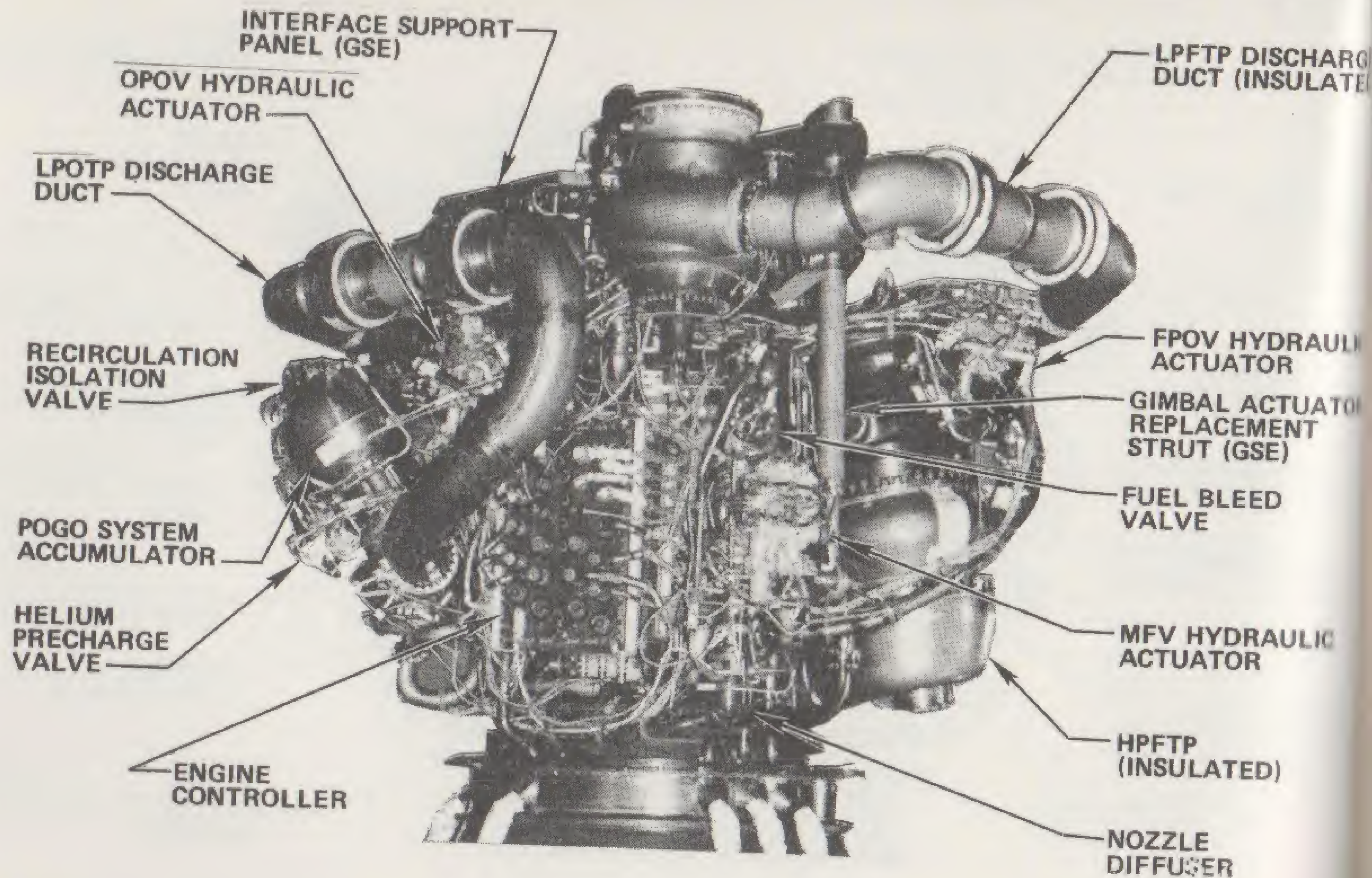


FIGURE 2-3. SSME TYPICAL VIEWS (VIEW 4) (SHEET 4 OF 8)

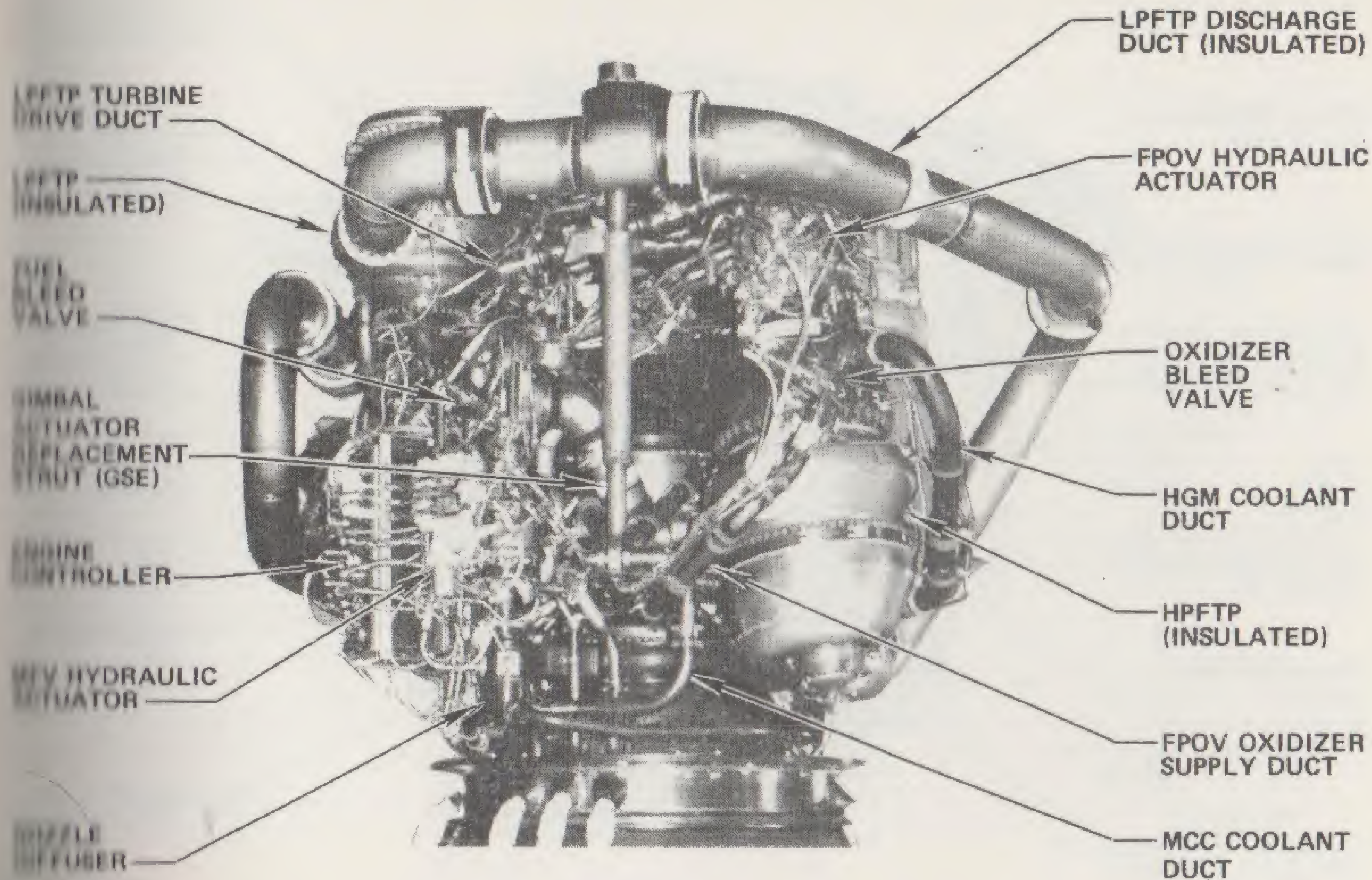
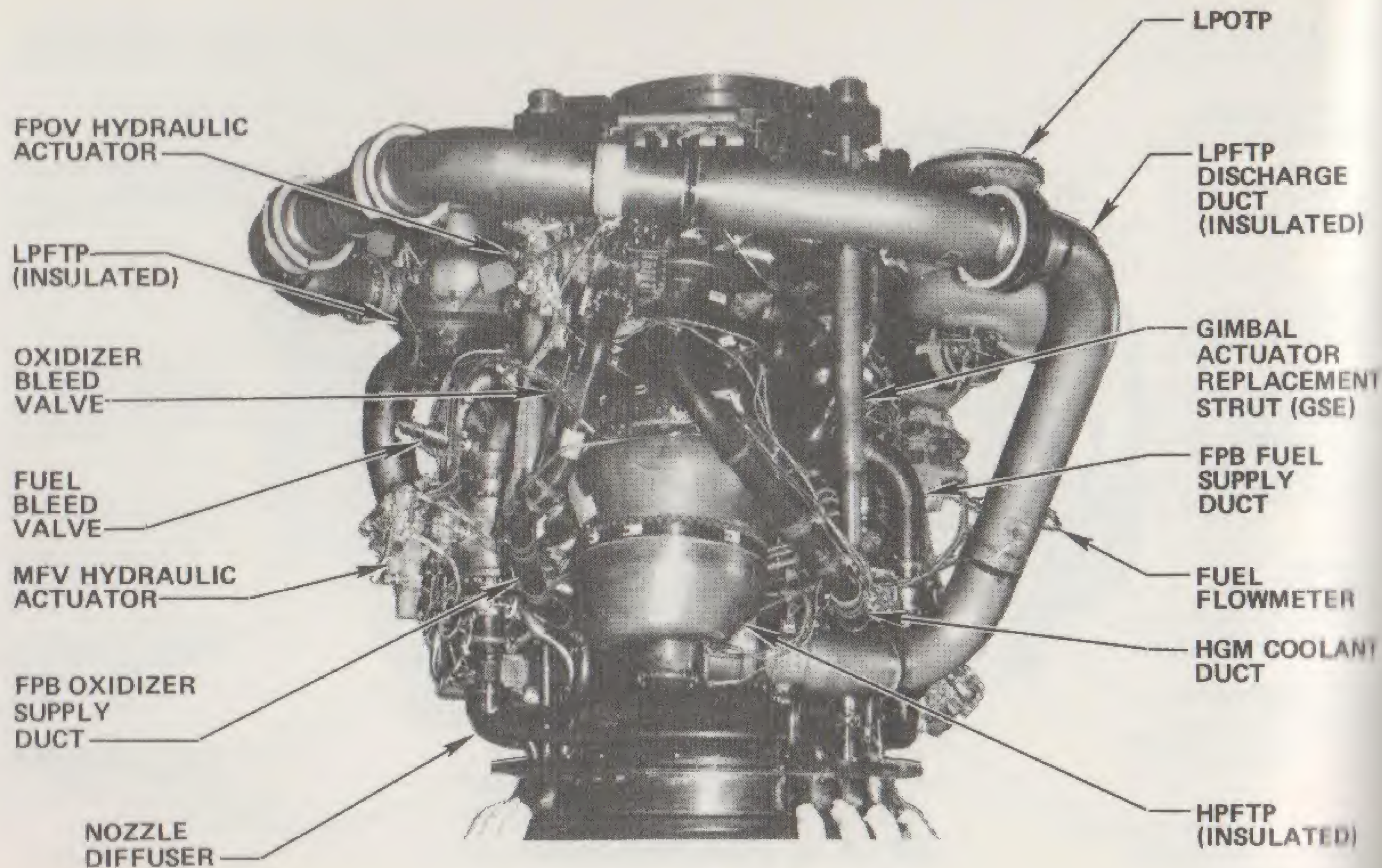


FIGURE 2-3. SSME TYPICAL VIEWS (VIEW 5) (SHEET 5 OF 8)



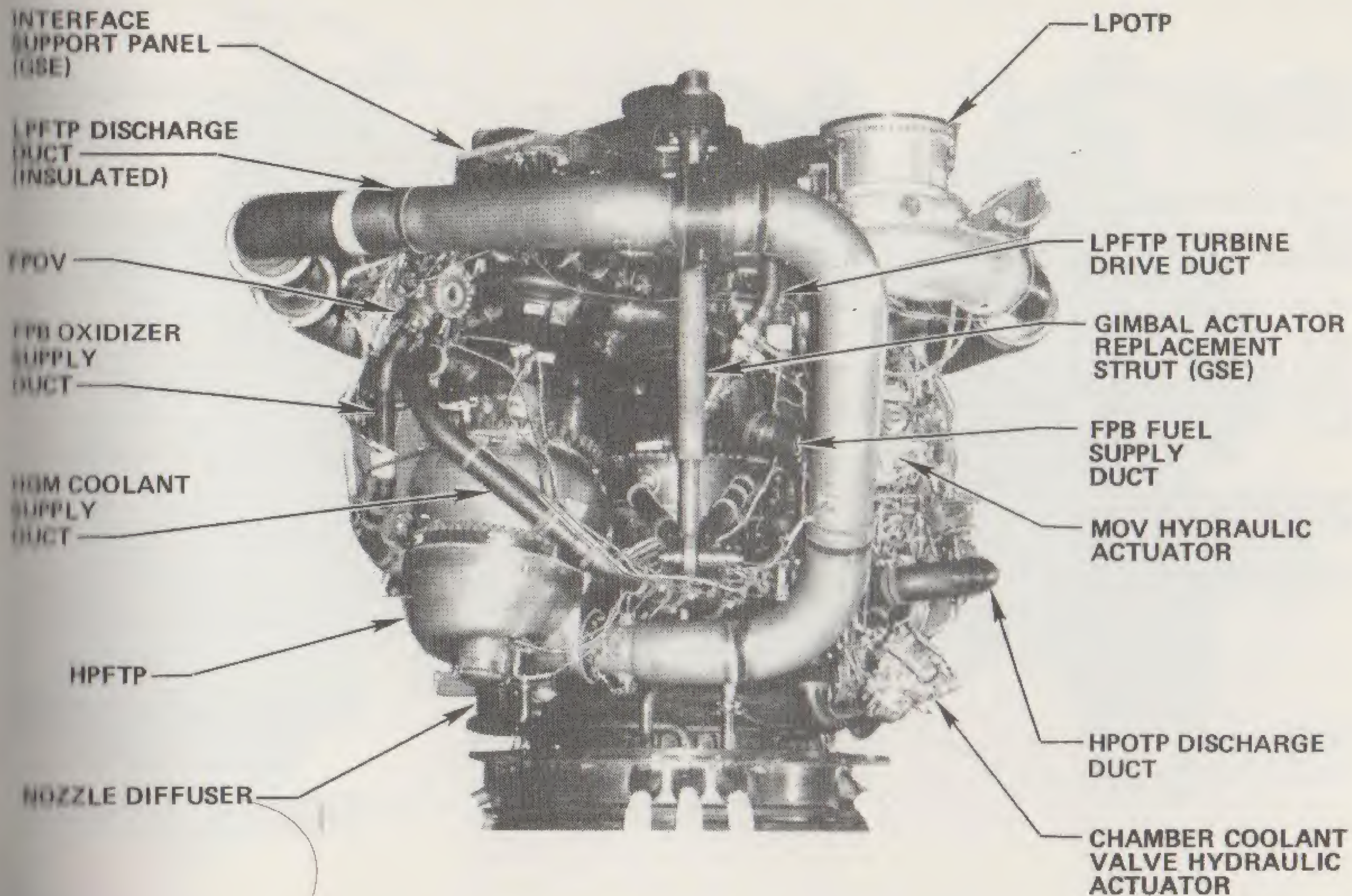
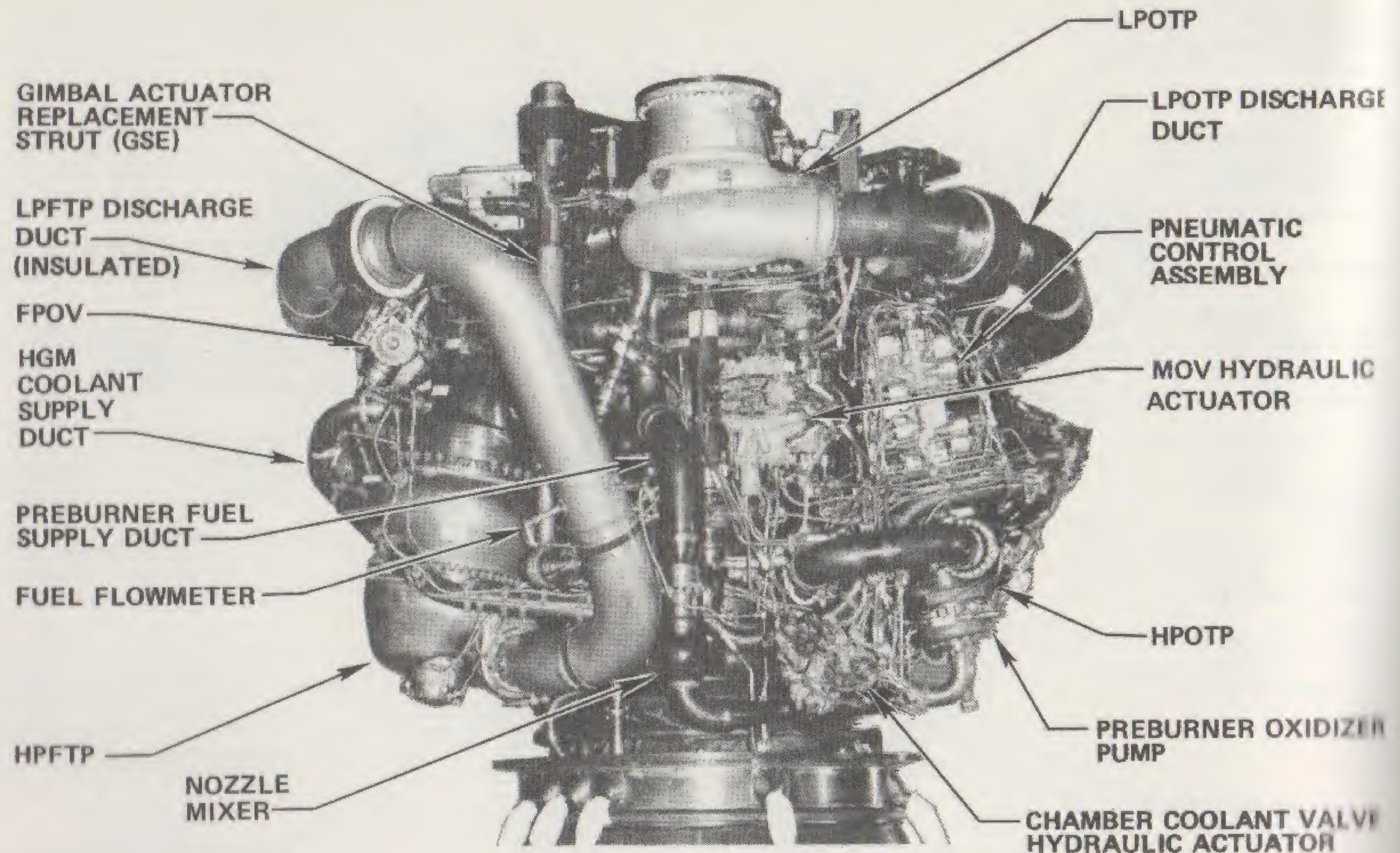


FIGURE 2-3. SSME TYPICAL VIEWS (VIEW 7) (SHEET 7 OF 8)



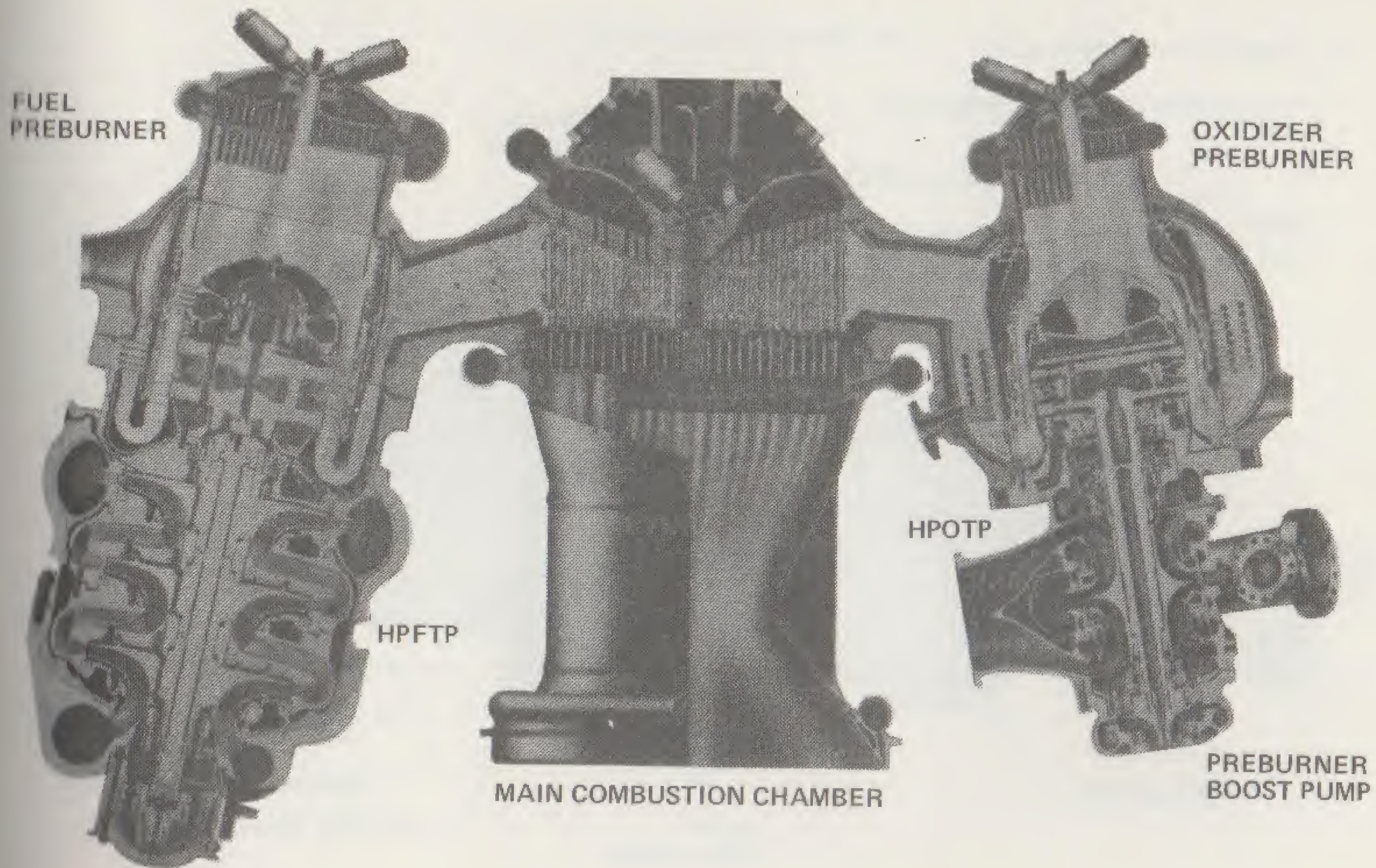


FIGURE 2-4. SSME POWERHEAD COMPONENT ARRANGEMENT

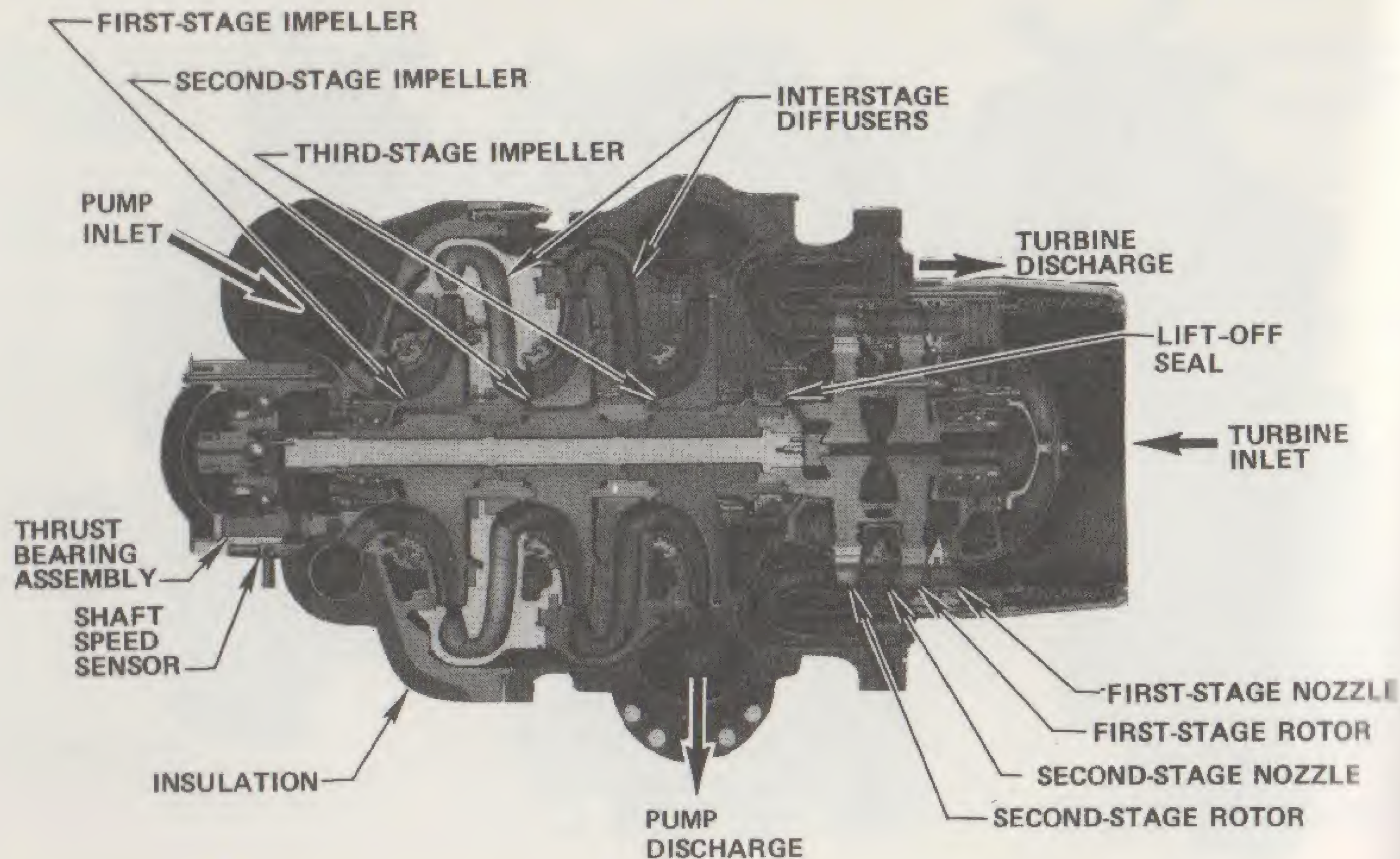
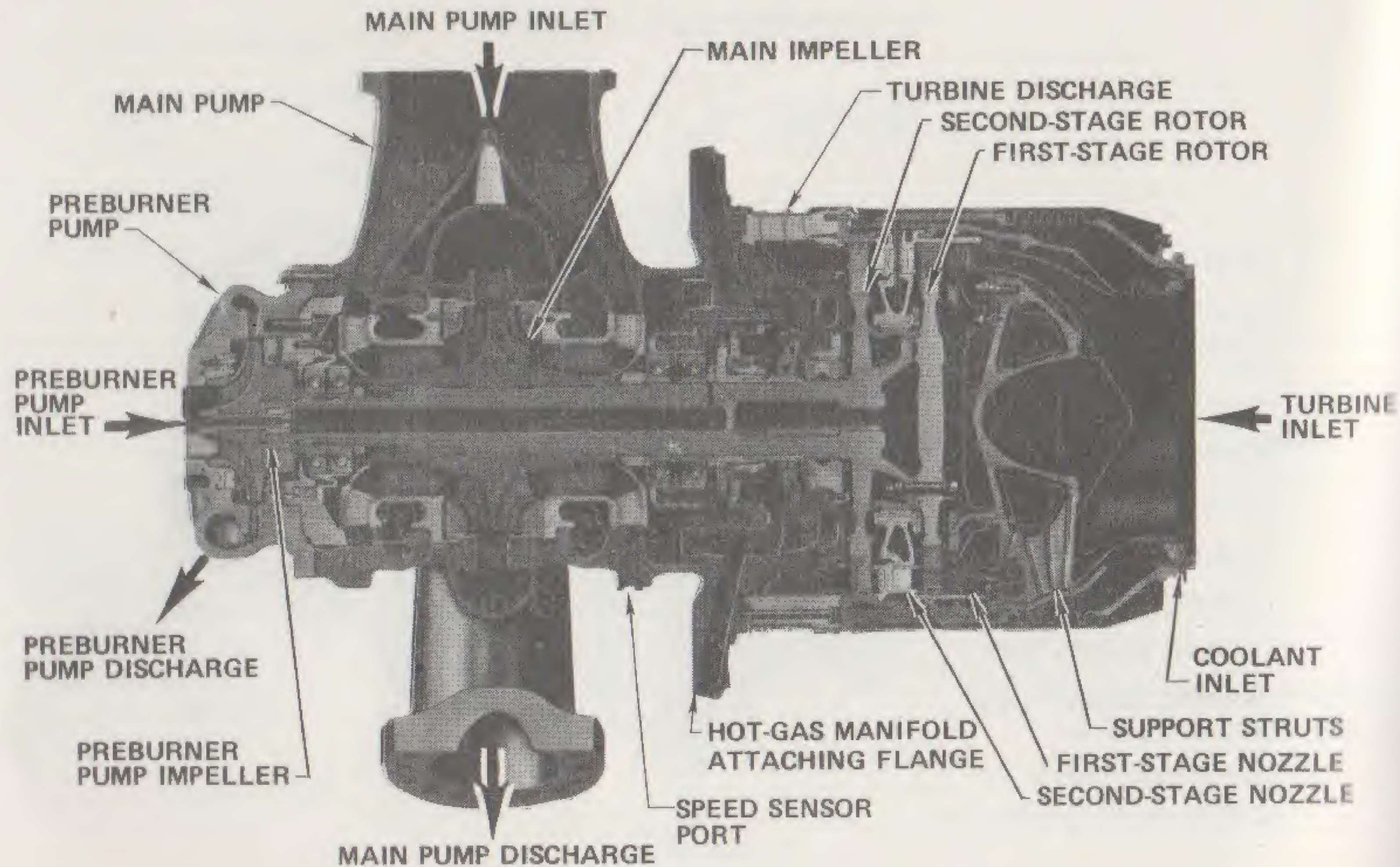


FIGURE 2-5. HIGH-PRESSURE FUEL TURBOPUMP (SHEET 1 OF 2)

KEY PERFORMANCE PARAMETERS

	<u>100%</u>	<u>109%</u>
PUMP INLET FLOWRATE (LB/SEC)	149.1	162.5
PUMP INLET PRESSURE (PSIA)	222.4	237.5
PUMP DISCHARGE PRESSURE (PSIA)	6110.4	6871.7
PUMP EFFICIENCY	.763	.760
TURBINE FLOWRATE (LB/SEC)	158.6	177.6
TURBINE INLET TEMP (°R)	1794.5	1903.7
TURBINE PRESSURE RATIO	1.411	1.440
TURBINE EFFICIENCY	.839	.842
TURBINE SPEED (RPM)	34,386	36,595
TURBINE HORSEPOWER	61,402	74,928

FIGURE 2-5. HIGH-PRESSURE FUEL TURBOPUMP (SHEET 2 OF 2)



KEY PERFORMANCE PARAMETERS

	100%		109%	
	MAIN	BOOST	MAIN	BOOST
PUMP INLET FLOWRATE (LB/SEC)	1072.1	109.1	1162.5	125.8
PUMP INLET PRESSURE (PSIA)	379.9	3992.2	392.3	4428.7
PUMP DISCHARGE PRESSURE (PSIA)	4118.4	7210.9	4578.2	7935.9
PUMP EFFICIENCY	.686	.808	.681	.805
TURBINE FLOWRATE (LB/SEC)	58.8		65.49	
TURBINE INLET PRESSURE (PSIA)	5020.0		5631.6	
TURBINE INLET TEMP (°R)	1522.5		1625.4	
TURBINE PRESSURE RATIO	1.513		1.547	
TURBINE EFFICIENCY	.759		.769	
TURBINE SPEED (RPM)	27,263		29,194	
TURBINE HORSEPOWER	23,068		28,229	

FIGURE 2-6. HIGH-PRESSURE OXIDIZER TURBOPUMP (SHEET 2 OF 2)

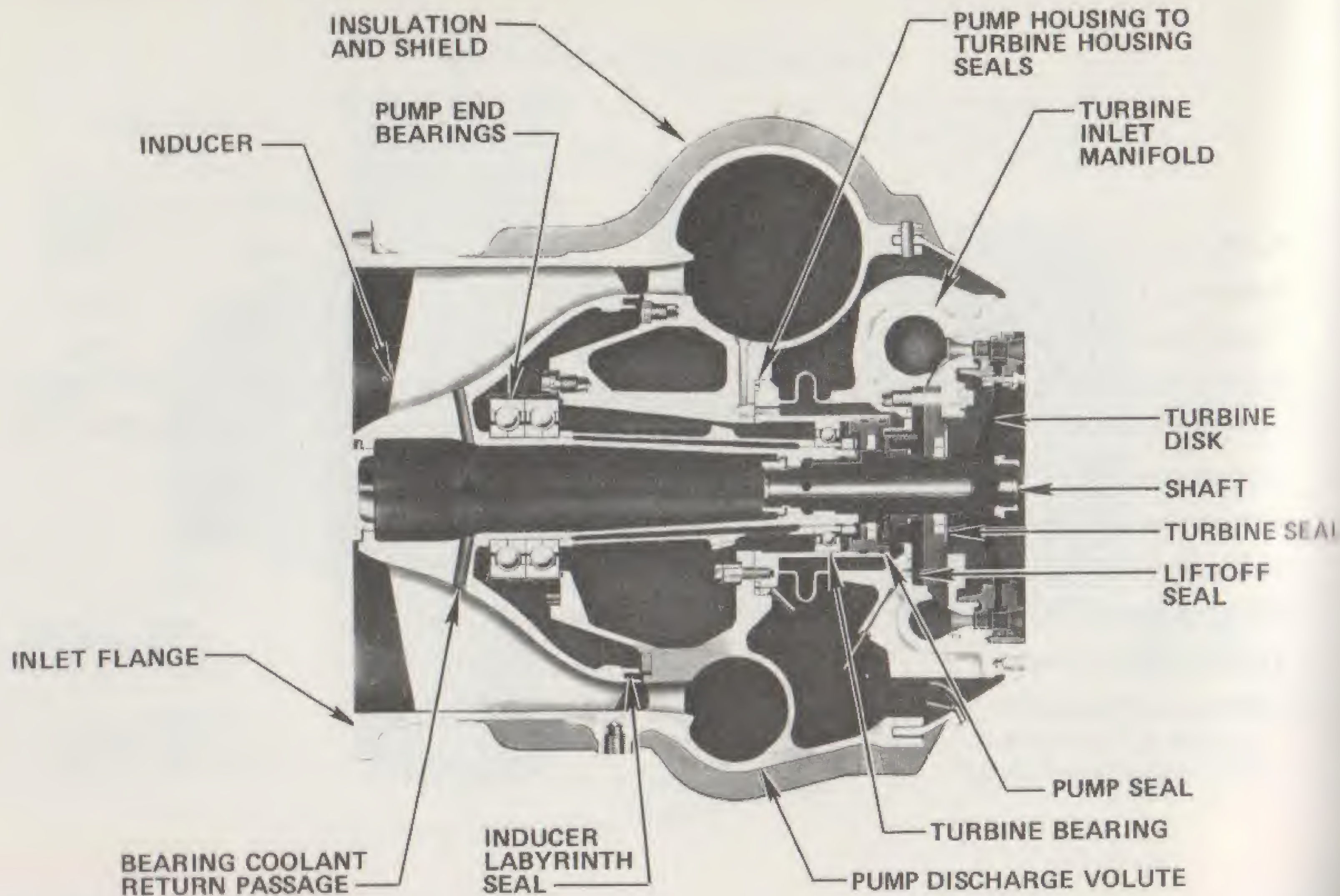


FIGURE 2-7. LOW-PRESSURE FUEL TURBOPUMP (SHEET 1 OF 2)

KEY PERFORMANCE PARAMETERS

	<u>100%</u>	<u>109%</u>
PUMP INLET FLOWRATE (LB/SEC)	148.6	161.9
PUMP INLET PRESSURE (PSIA)	30.0	30.0
PUMP DISCHARGE PRESSURE (PSIA)	280.5	306.3
PUMP EFFICIENCY	.774	.749
TURBINE FLOWRATE (LB/SEC)	26.1	29.5
TURBINE INLET TEMP (°R)	493.4	479
TURBINE PRESSURE RATIO	1.32	1.34
TURBINE EFFICIENCY	.519	.523
TURBINE SPEED (RPM)	15765	16722
TURBINE HORSEPOWER	2950	3518

FIGURE 2-7. LOW-PRESSURE FUEL TURBOPUMP (SHEET 2 OF 2)

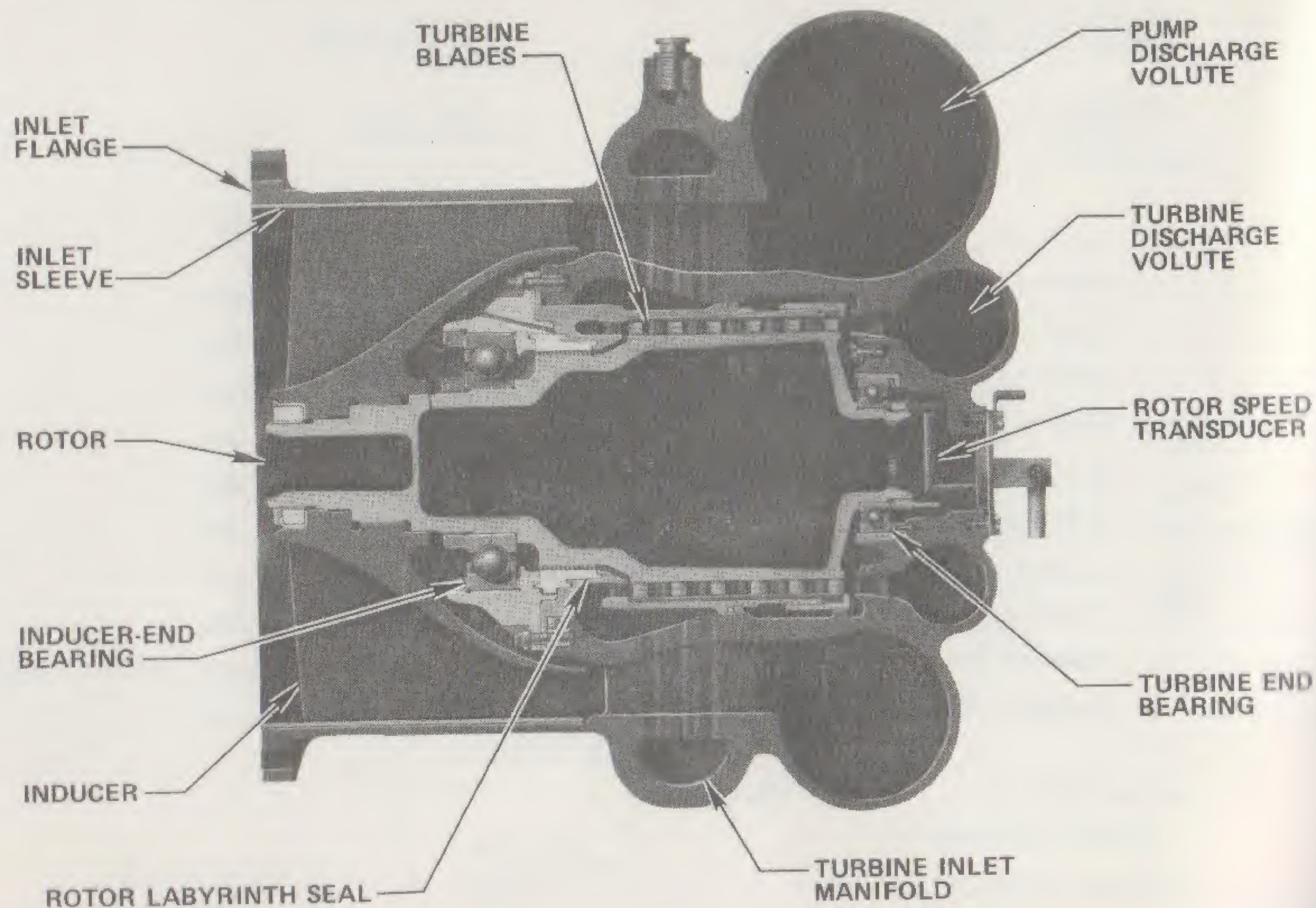


FIGURE 2-8. LOW-PRESSURE OXIDIZER TURBOPUMP (SHEET 1 OF 2)

KEY PERFORMANCE PARAMETERS

	<u>100%</u>	<u>109%</u>
PUMP INLET FLOWRATE (LB/SEC)	895.8	975.1
PUMP INLET PRESSURE (PSIA)	100.0	100.0
PUMP DISCHARGE PRESSURE (PSIA)	414.2	432.7
PUMP EFFICIENCY	.689	.671
TURBINE FLOWRATE (LB/SEC)	176.3	186.4
TURBINE INLET PRESSURE (PSIA)	3951.1	4390.9
TURBINE INLET TEMP (°R)	190.2	193.5
TURBINE PRESSURE RATIO	-	-
TURBINE EFFICIENCY	.649	.649
TURBINE SPEED (RPM)	5042.1	5814.6
TURBINE HORSEPOWER	1504.8	1782.0

FIGURE 2-8. LOW-PRESSURE OXIDIZER TURBOPUMP (SHEET 2 OF 2)

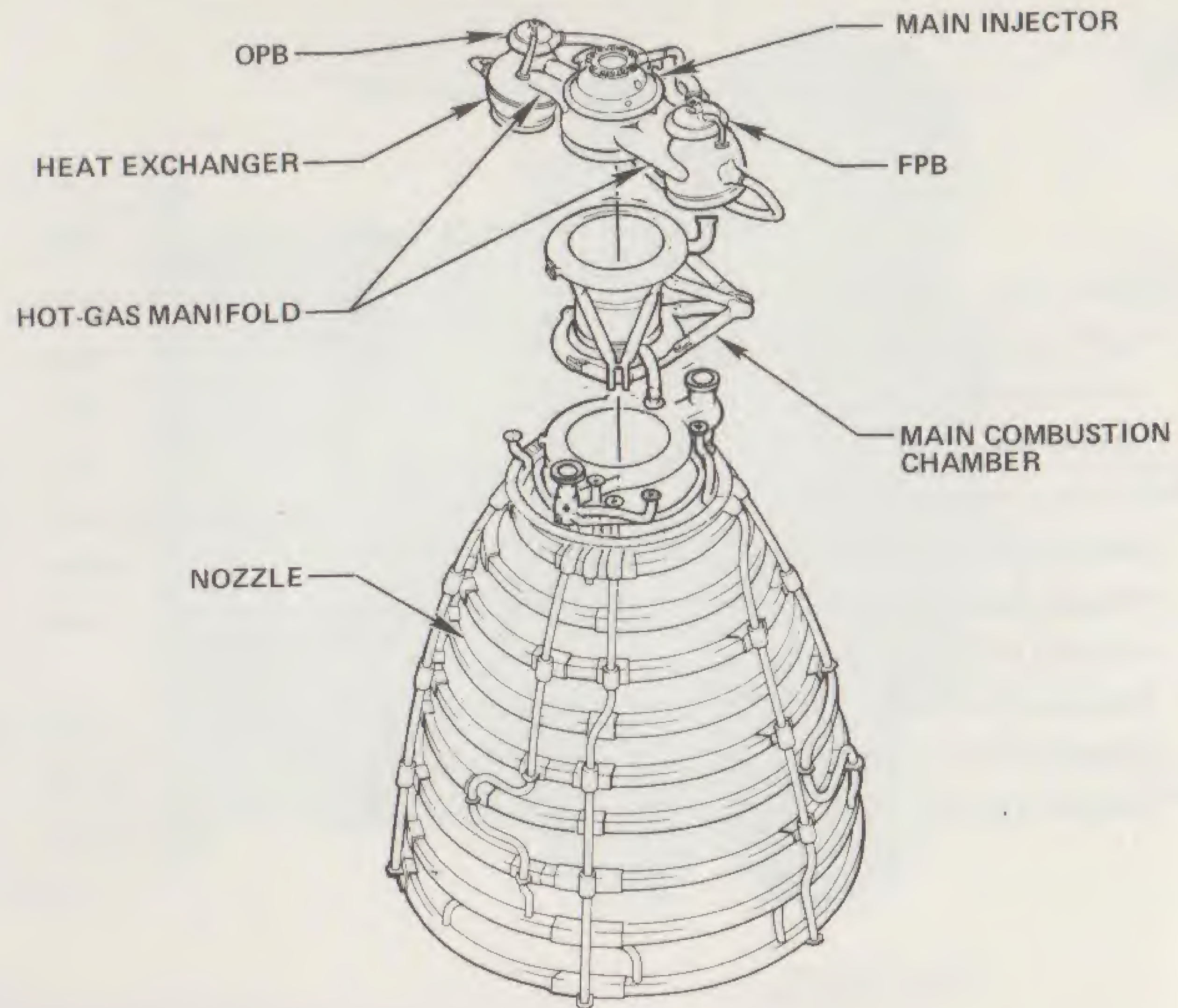


FIGURE 2-9. SSME COMBUSTION DEVICES

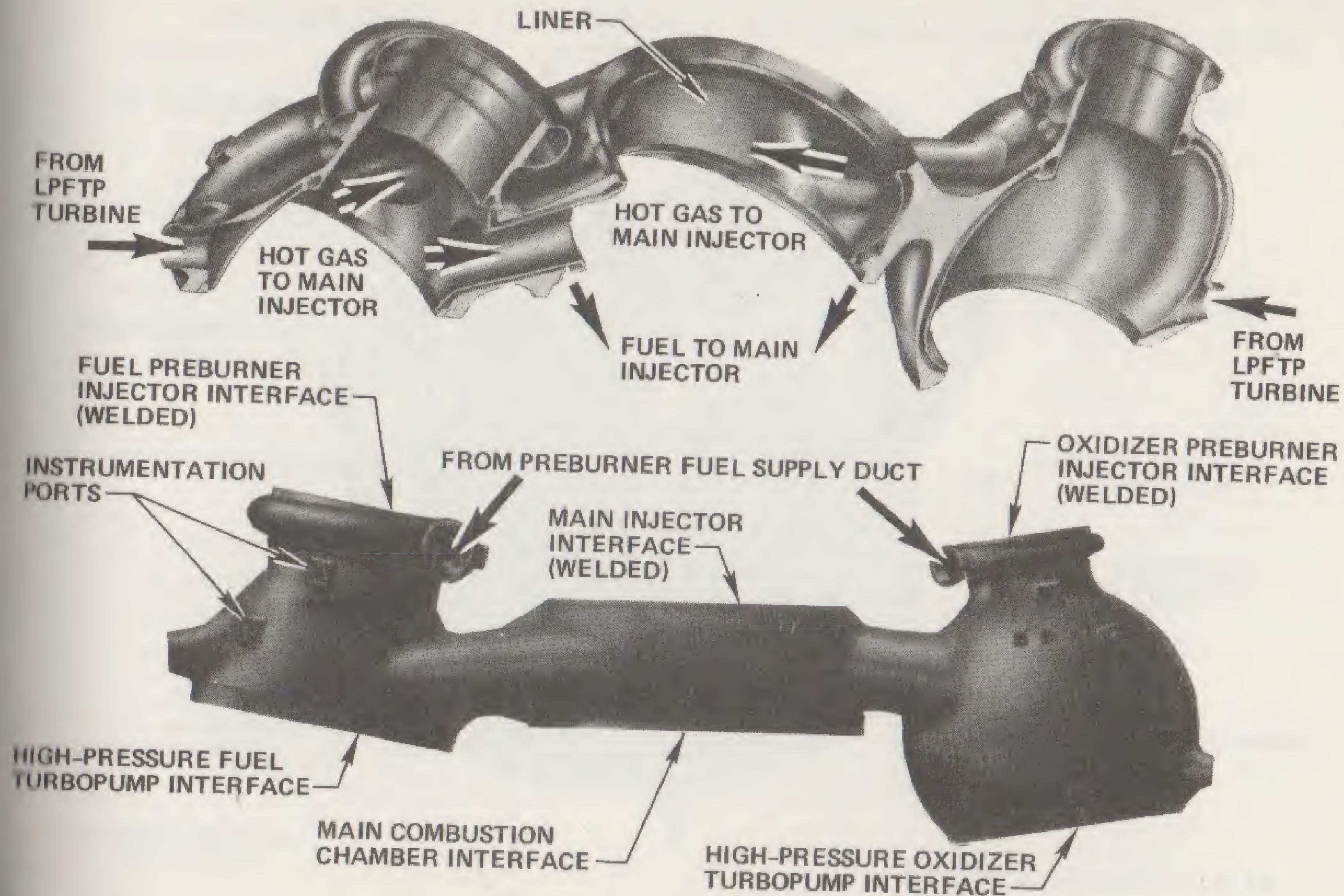


FIGURE 2-10. HOT-GAS MANIFOLD

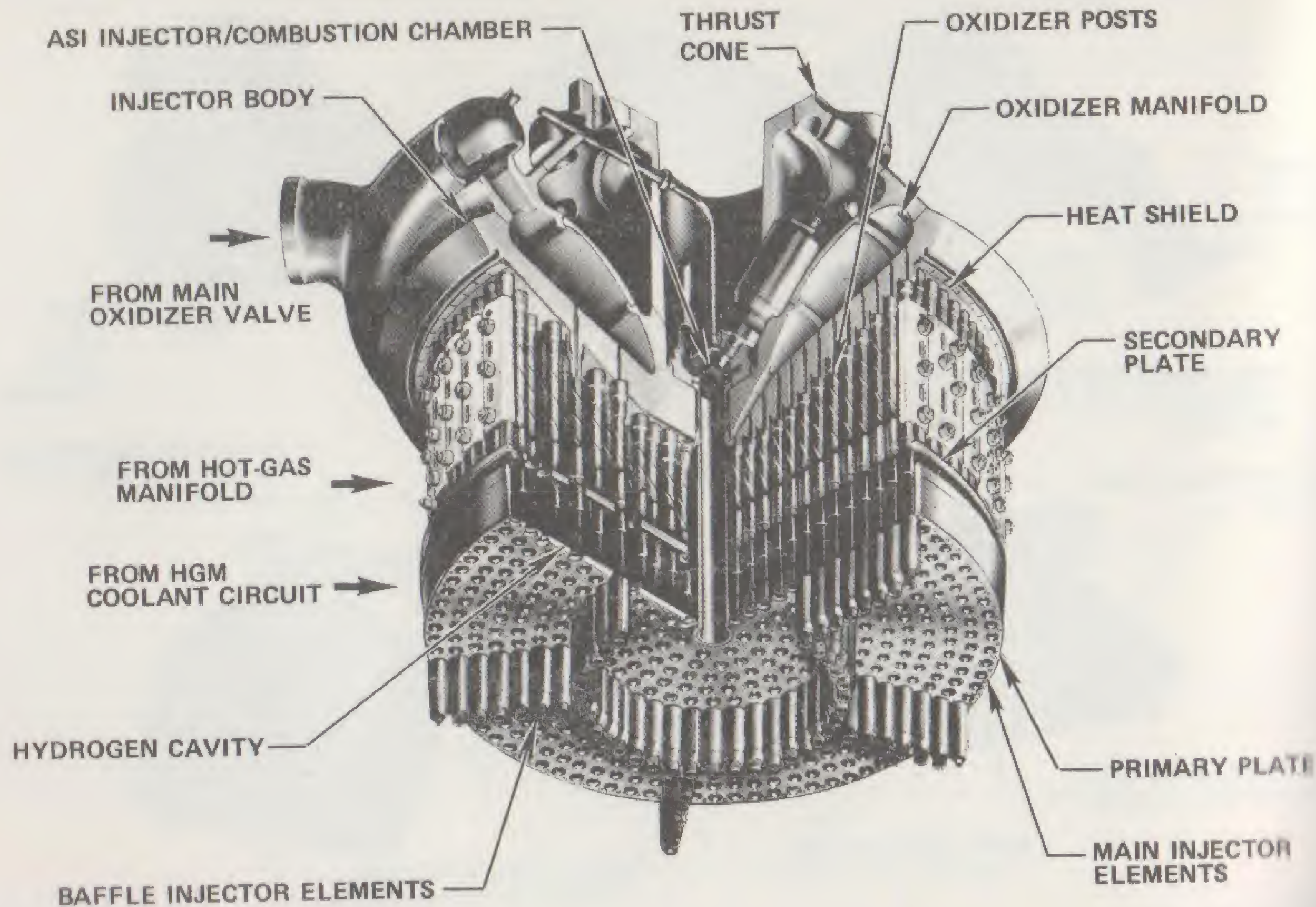


FIGURE 2-11. MAIN INJECTOR (SHEET 1 OF 2)

GEOMETRY

● .347 CRES RIGIMESH FACEPLATES	
● DUAL SPARK IGNITER	
● FACE DIAMETER	17.74 IN.
● INJECTOR CONFIGURATION	CONCENTRIC ORIFICE
● NUMBER OF ELEMENTS	525
● NUMBER OF FLOW SHIELDS	42
● NUMBER OF BAFFLE ELEMENTS	75
● BAFFLE ELEMENT LENGTH	2 IN.

OPERATING PARAMETERS (RPL, MR-6.026)

	<u>100%</u>	<u>109%</u>
● CHAMBER PRESSURE (PSIA)	3006	3277
● OXIDIZER FLOWRATE (LB/SEC)	792.4	856.1
● HOT GAS FLOWRATE (LB/SEC)	225.8	252.4
● COOLANT FLOWRATE (LB/SEC)		
● PRIMARY FACEPLATE	4.3	5.0
● SECONDARY FACEPLATE	2.9	3.4
● BAFFLES	16.5	18.5

FIGURE 2-11. MAIN INJECTOR (SHEET 2 OF 2)

MAIN INJECTOR ELEMENT

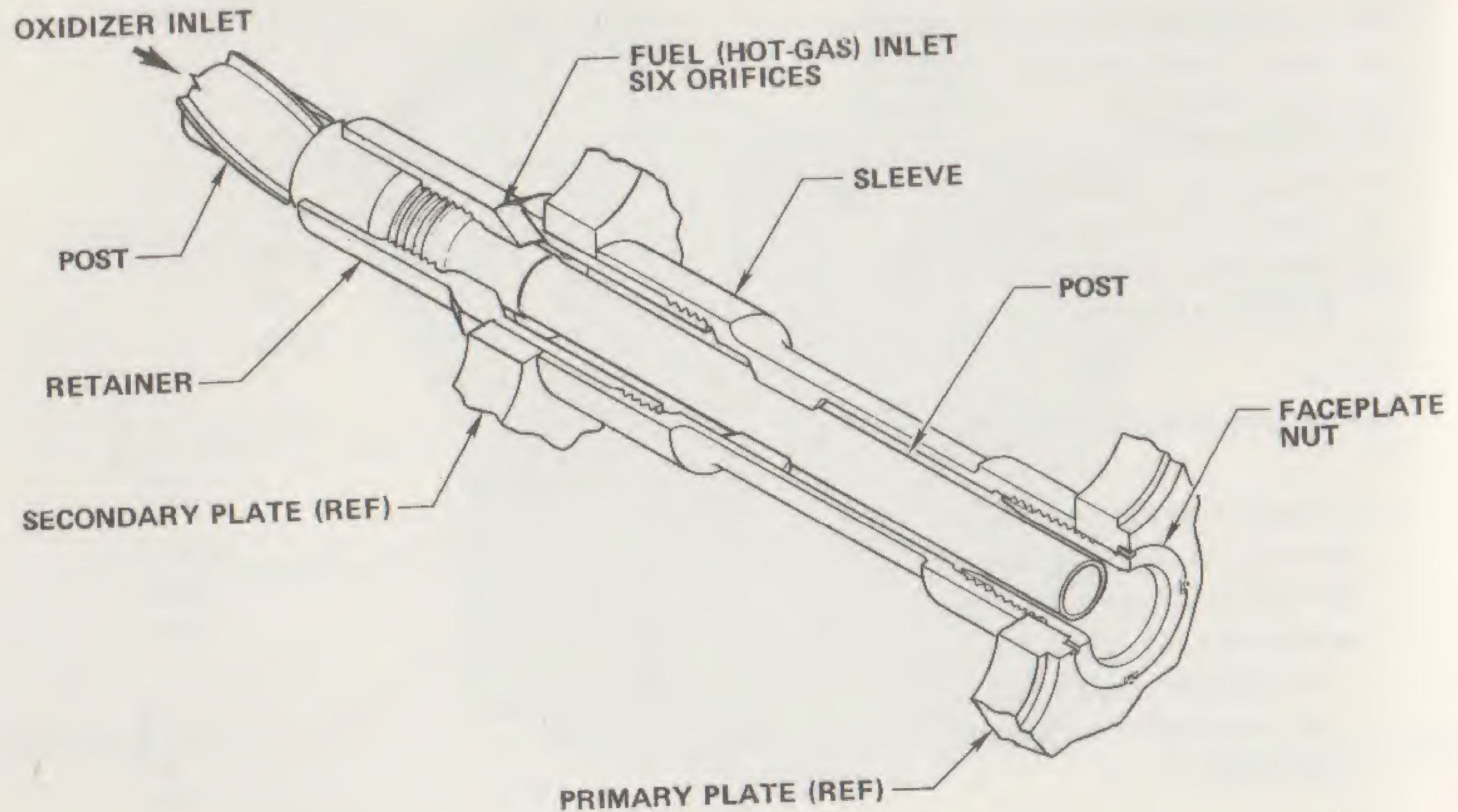


FIGURE 2-12. MAIN INJECTOR ELEMENTS (SHEET 1 OF 2)

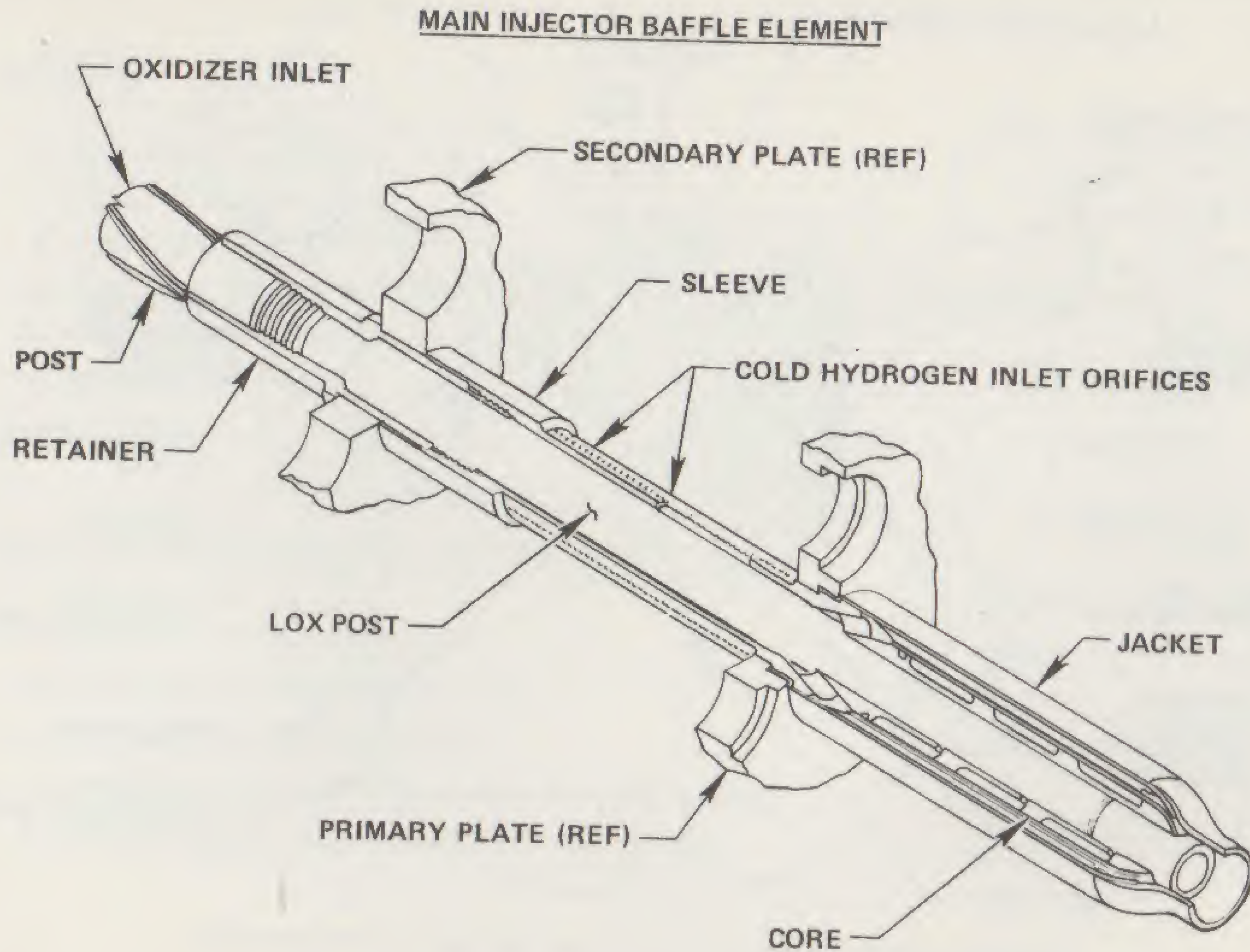


FIGURE 2-12. MAIN INJECTOR ELEMENTS (SHEET 2 OF 2)

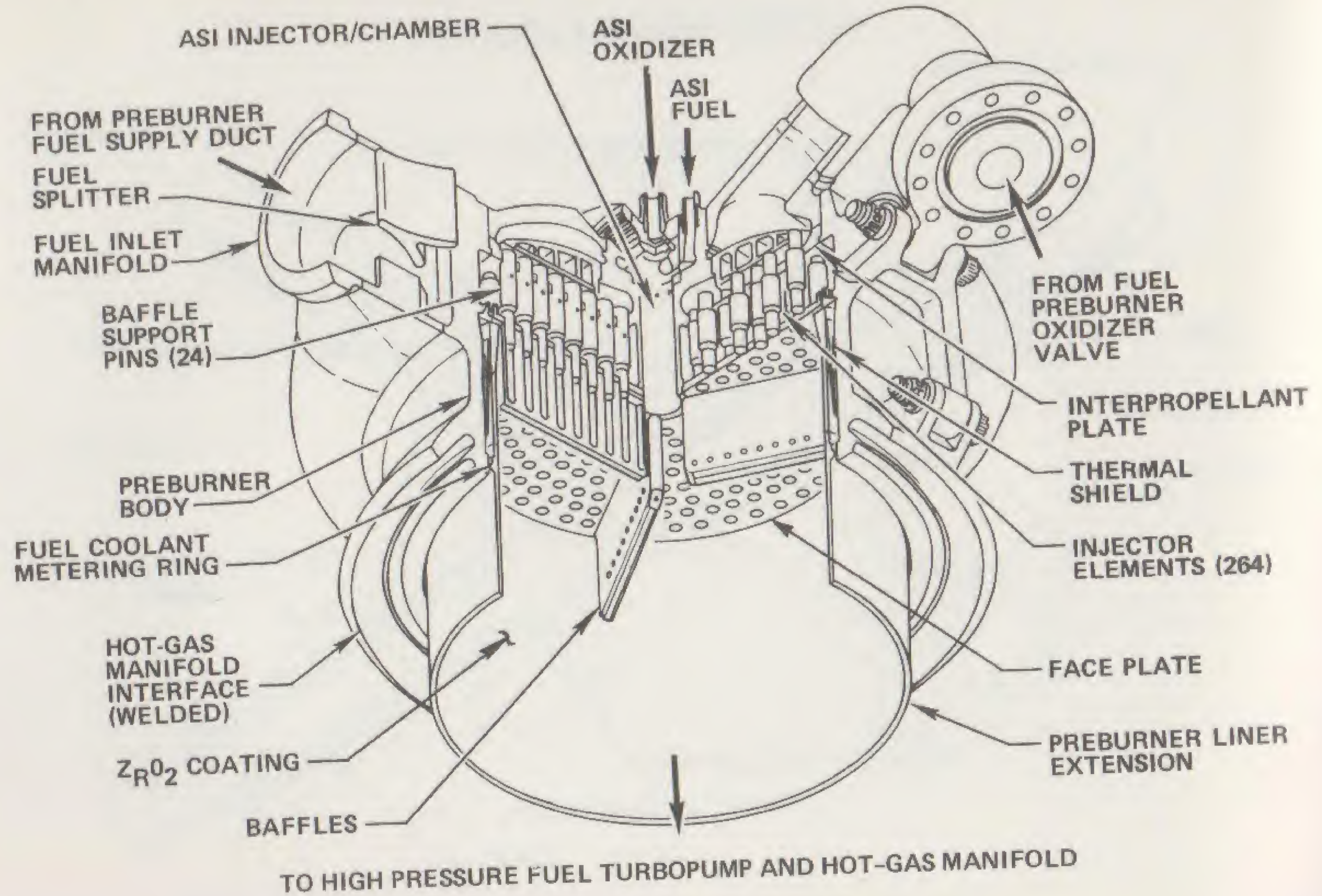


FIGURE 2-13. FUEL PREBURNER (SHEET 1 OF 2)

GEOMETRY

● INTERNAL DIAMETER	10.43 IN.
● COMBUSTOR LENGTH	4.37 IN.
● INCO 625 FACEPLATE	
● INJECTOR CONFIGURATION	CONCENTRIC ORIFICE
● NUMBER OF ELEMENTS	264
● BAFFLE LENGTH	2.25 IN.
● MATERIAL	NARLOY-A

OPERATING PARAMETERS (RPL, MR-6.026)

	<u>100%</u>	<u>109%</u>
● INJECTOR END PRESSURE (PSIA)	4868	5462
● COMBUSTION TEMPERATURE (°R)	1794	1904
● HOT GAS MIXTURE RATIO (O/F)	0.9152	0.9813
● OXIDIZER FLOWRATE (INCLUDING IGNITER) (LB/SEC)	75.80	87.97
● FUEL FLOWRATE (INCLUDING IGNITER) (LB/SEC)	82.83	89.64

FIGURE 2-13. FUEL PREBURNER (SHEET 2 OF 2)

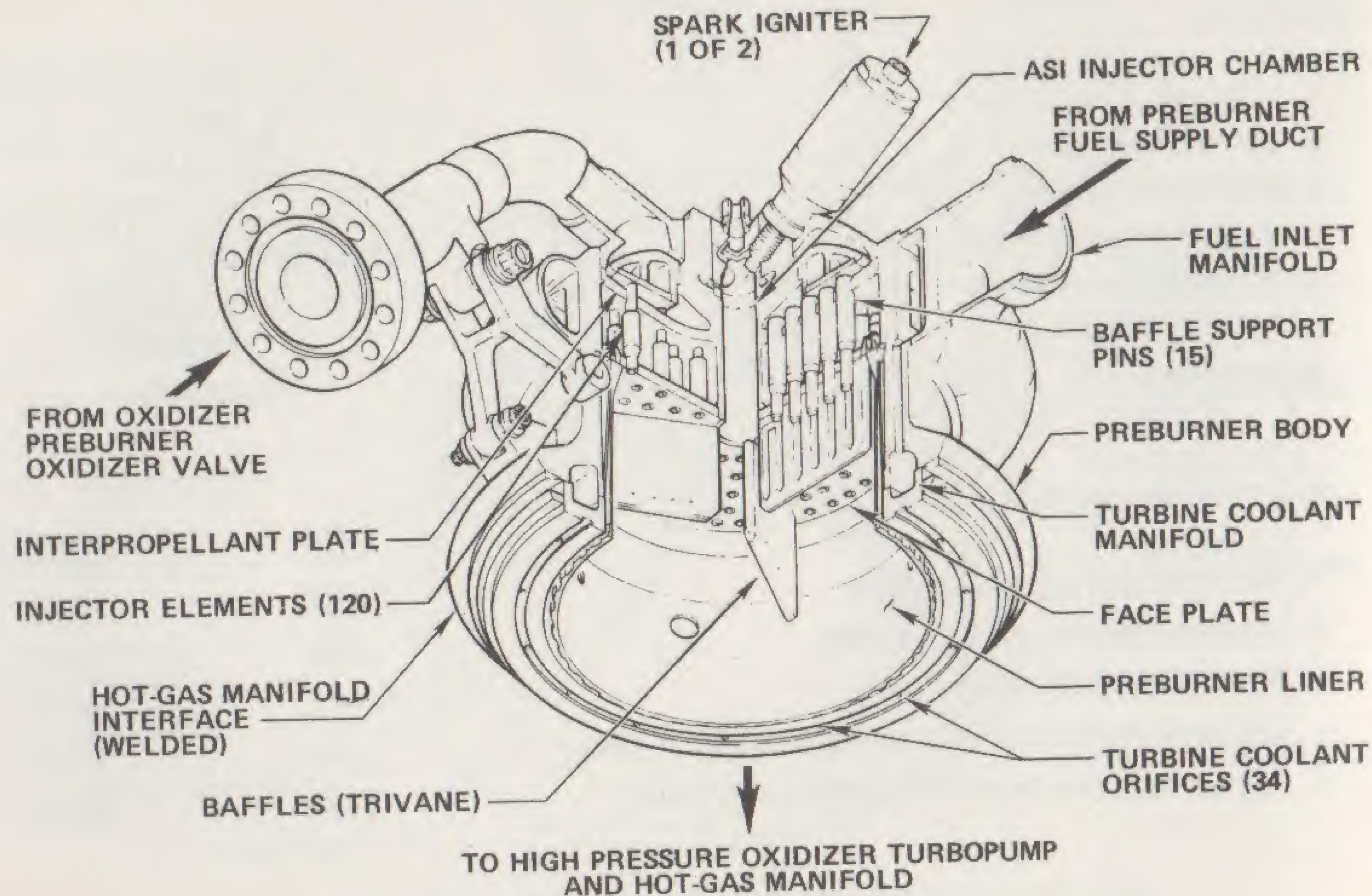


FIGURE 2-14. OXIDIZER PREBURNER (SHEET 1 OF 2)

GEOMETRY

● INTERNAL DIAMETER	7.43 IN.
● COMBUSTOR LENGTH	4.25 IN.
● INCO 625 FACEPLATE	
● INJECTOR CONFIGURATION	CONCENTRIC ORIFICE
● NUMBER OF ELEMENTS	120
● BAFFLE LENGTH	2.25 IN.
● MATERIAL	NARLOY-A

OPERATING PARAMETERS (RPL, MR-6.0)

	<u>100%</u>	<u>109%</u>
● CHAMBER PRESSURE (PSIA)	5039	5654
● COMBUSTION TEMPERATURE (°R)	1522	1625
● HOT GAS MIXTURE RATIO (O/F)	0.7453	0.8051
● OXIDIZER FLOWRATE (INCLUDING IGNITER) (LB/SEC)	25.11	29.21
● FUEL FLOWRATE (INCLUDING IGNITER) (LB/SEC)	35.16	37.92

FIGURE 2-14. OXIDIZER PREBURNER (SHEET 2 OF 2)

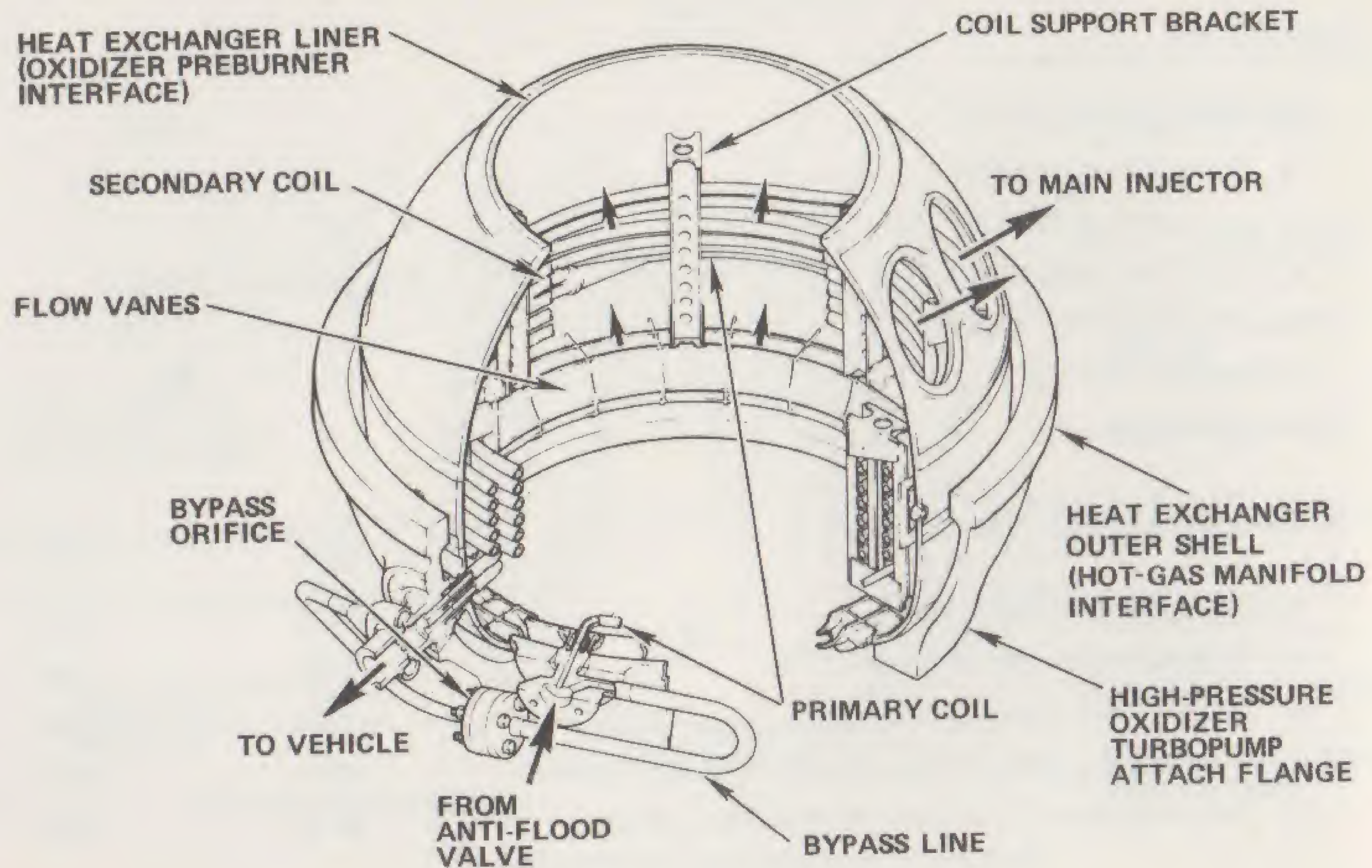


FIGURE 2-15. HEAT EXCHANGER (SHEET 1 OF 2)

- SUPPLIES HOT OXYGEN FOR EXTERNAL TANK AND POGO ACCUMULATOR PRESSURIZATION
- 850°R, 1.1–2.2 LB_M/SEC @ RPL TO VEHICLE PER ENGINE
- BYPASS SYSTEM, RESULTS IN SMALL $\frac{\partial T}{\partial W}$
- HEATED BY HPOTP TURBINE EXHAUST GASES (1370°R @ RPL)
- HEAT LOAD = 1.08 1.91 X 10⁶ BTU/HR @ RPL
- 316L CRES TUBING
 - PRIMARY — .215 O.D. X .0125 W. X 2.6 FT
 - SECONDARY — .382 O.D. X .0265 W. X 26.4 FT (2 EA)
- TUBES SUPPORTED BY 8 BRACKETS
- ASSEMBLY WELDED TO HGM

FIGURE 2-15. HEAT EXCHANGER (SHEET 2 OF 2)

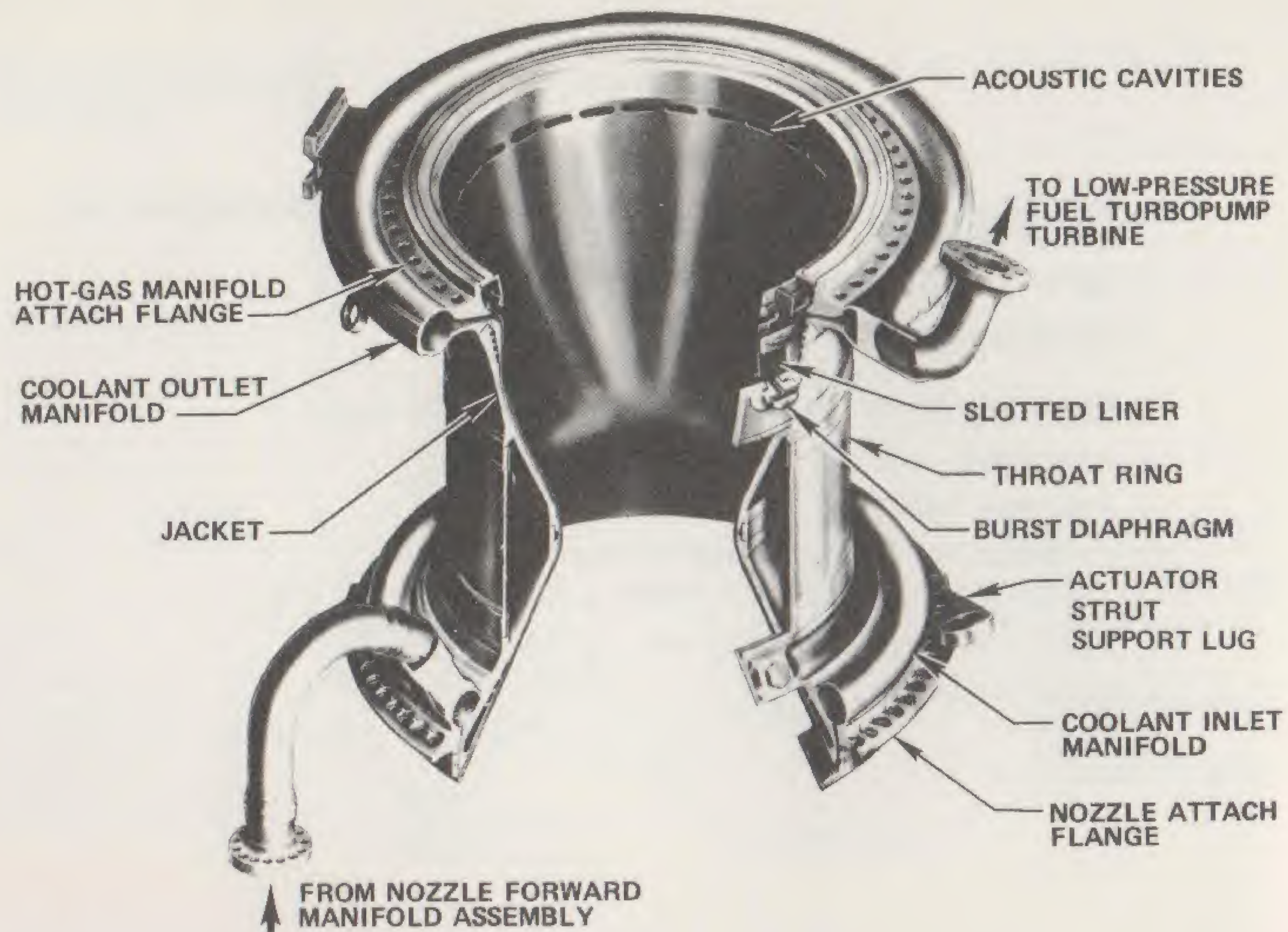


FIGURE 2-16. MAIN COMBUSTION CHAMBER (SHEET 1 OF 2)

GEOMETRY

● NARLOY Z LINER + EDCu BARRIER + EDNi CLOSE-OUT + INCO 718 STRUCTURE SHELL	
● NUMBER OF SLOTS	390
● NUMBER OF ACOUSTIC CAVITIES	30
● INJECTOR END DIAMETER	17.74 IN.
● THROAT AREA	83.41 IN. ²
● INJECTOR END TO THROAT LENGTH	14.00 IN.
● CONTRACTION RATIO	2.96:1
● EXPANSION RATIO	5.0:1

OPERATING PARAMETERS (RPL, MR-6.0)

	<u>100%</u>	<u>109%</u>
● THROAT STAGNATION PRESSURE (PSIA)	3010	3282
● COOLANT INLET PRESSURE (PSIA)	5978	6718
● COOLANT INLET TEMPERATURE (°R)	95	101
● COOLANT EXIT PRESSURE (PSIA)	4756	5315
● COOLANT EXIT TEMPERATURE (°R)	493	479
● COOLANT FLOWRATE (LB/SEC)	26.09	29.46
● HOT-GAS WALL TEMPERATURE AT THROAT (°F)	1000	1000

FIGURE 2-16. MAIN COMBUSTION CHAMBER (SHEET 2 OF 2)

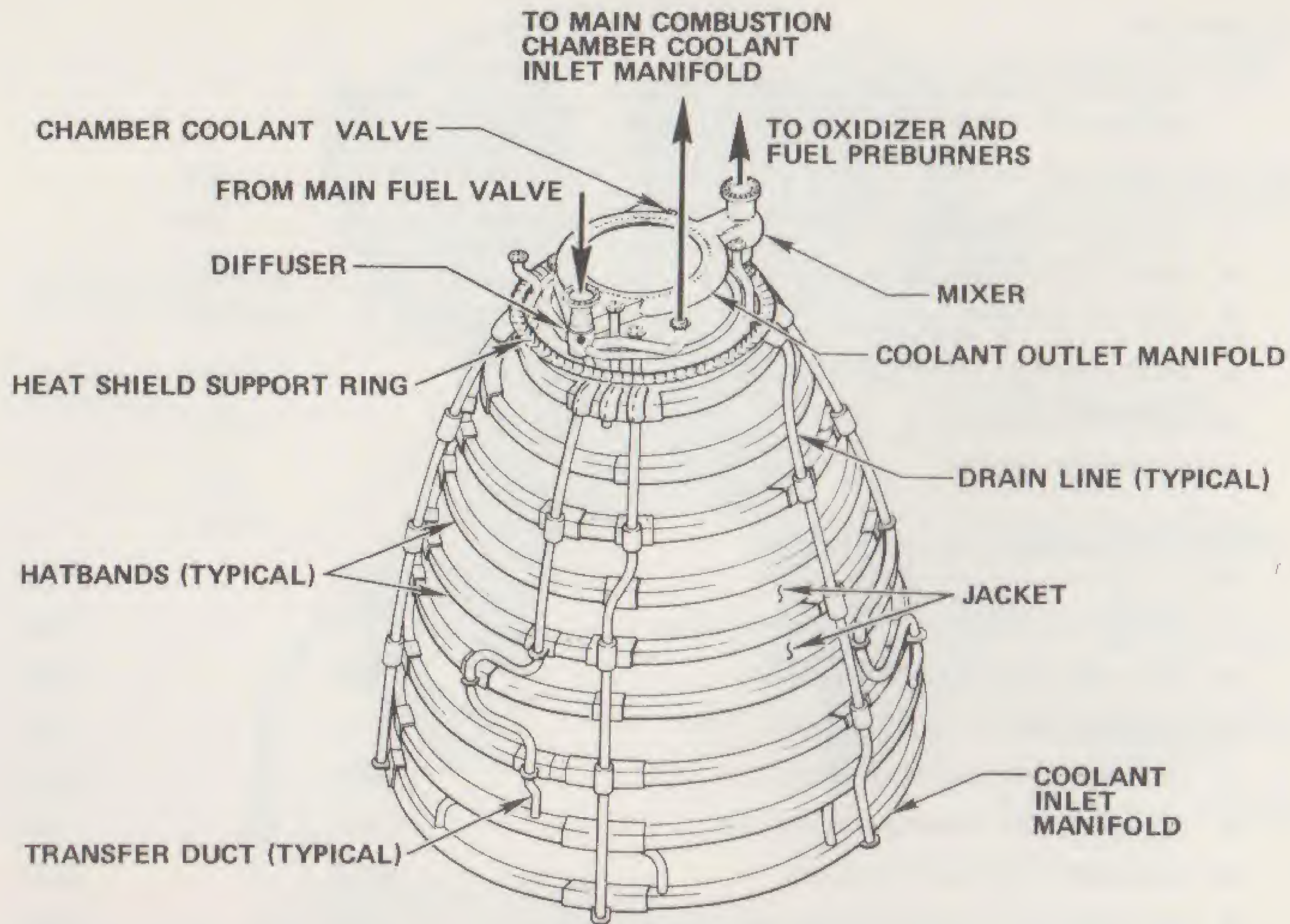


FIGURE 2-17. NOZZLE (SHEET 1 OF 2)

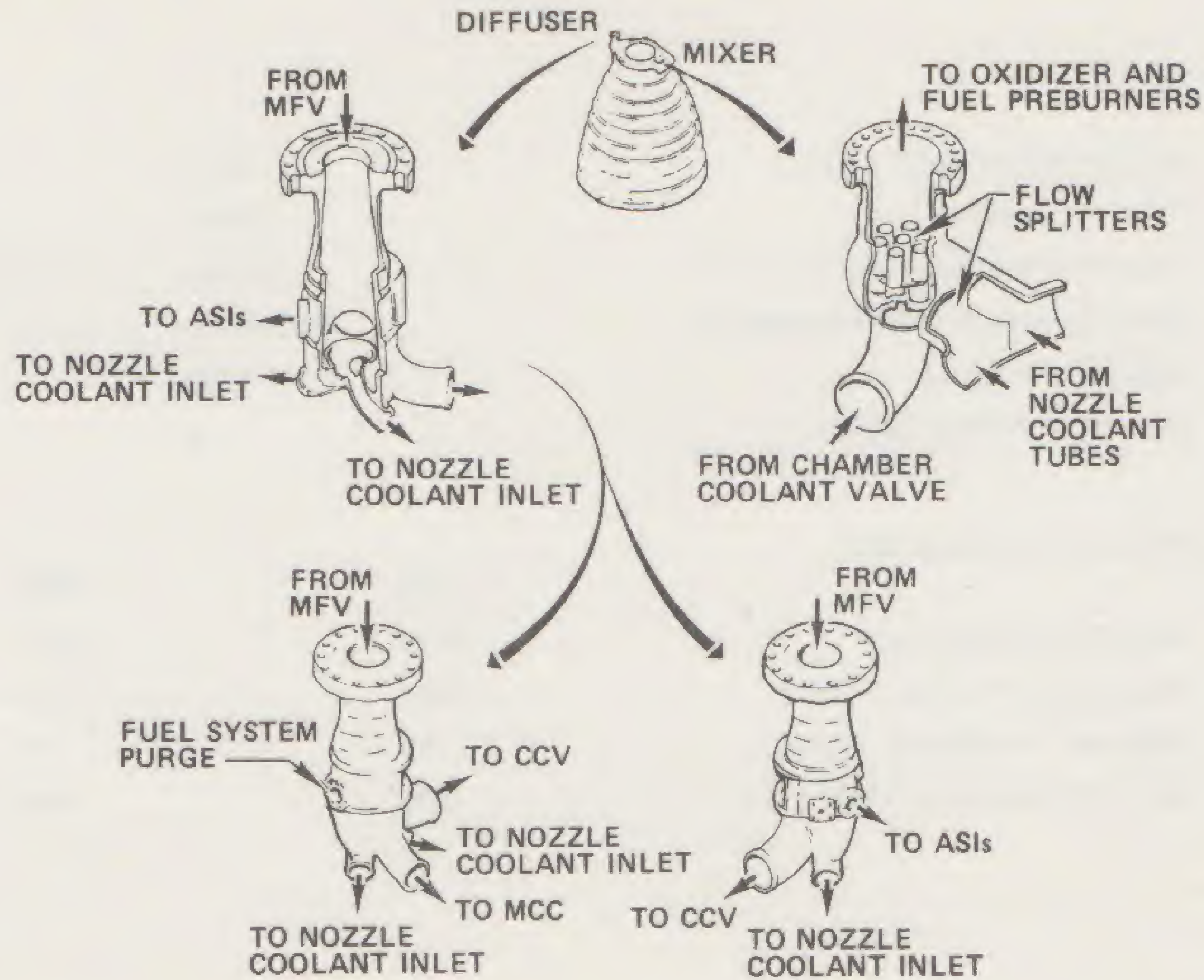


FIGURE 2-17. NOZZLE (SHEET 2 OF 2)

GEOMETRY

● ATTACH POINT AREA RATIO	5.0:1
● EXIT AREA RATIO	77.5:1
● LENGTH (THROAT TO EXIT)	121 IN.
● EXIT DIAMETER (INSIDE/OUTSIDE)	90.7/94 IN.
● NUMBER OF TUBES	1,080
● NUMBER OF FEED DUCTS	3

OPERATING PARAMETERS (RPL)

	<u>100%</u>	<u>109%</u>
● INLET PRESSURE (PSIA)	5999	6741
● DISCHARGE PRESSURE (PSIA)	5460	6110
● COOLANT FLOWRATE (LB/SEC)	54	63
● MAX HOT-GAS WALL TEMP (°F)	880	880

FIGURE 2-18. NOZZLE DIFFUSER AND MIXER

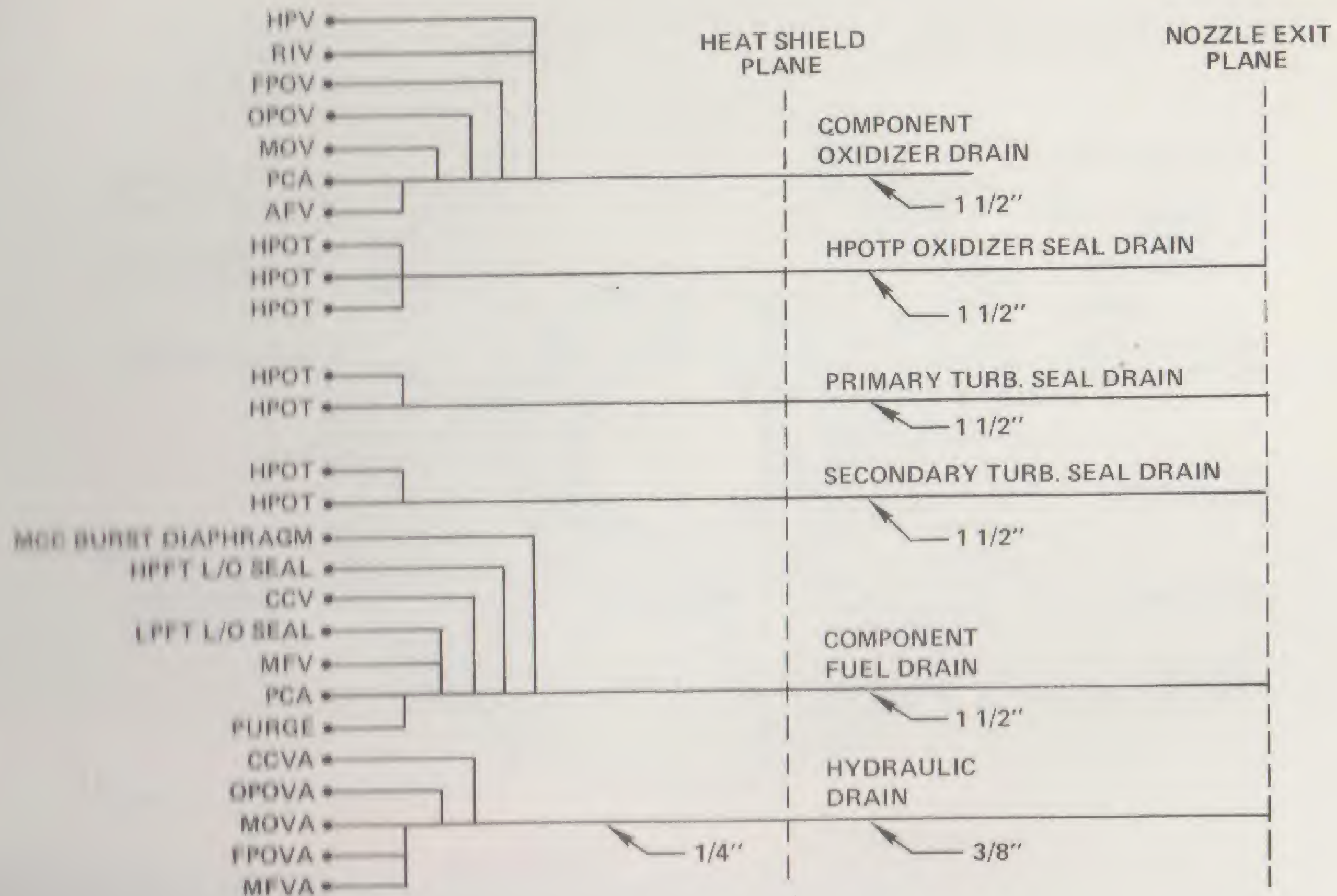


FIGURE 2-19. SSME DRAIN LINE SCHEMATIC

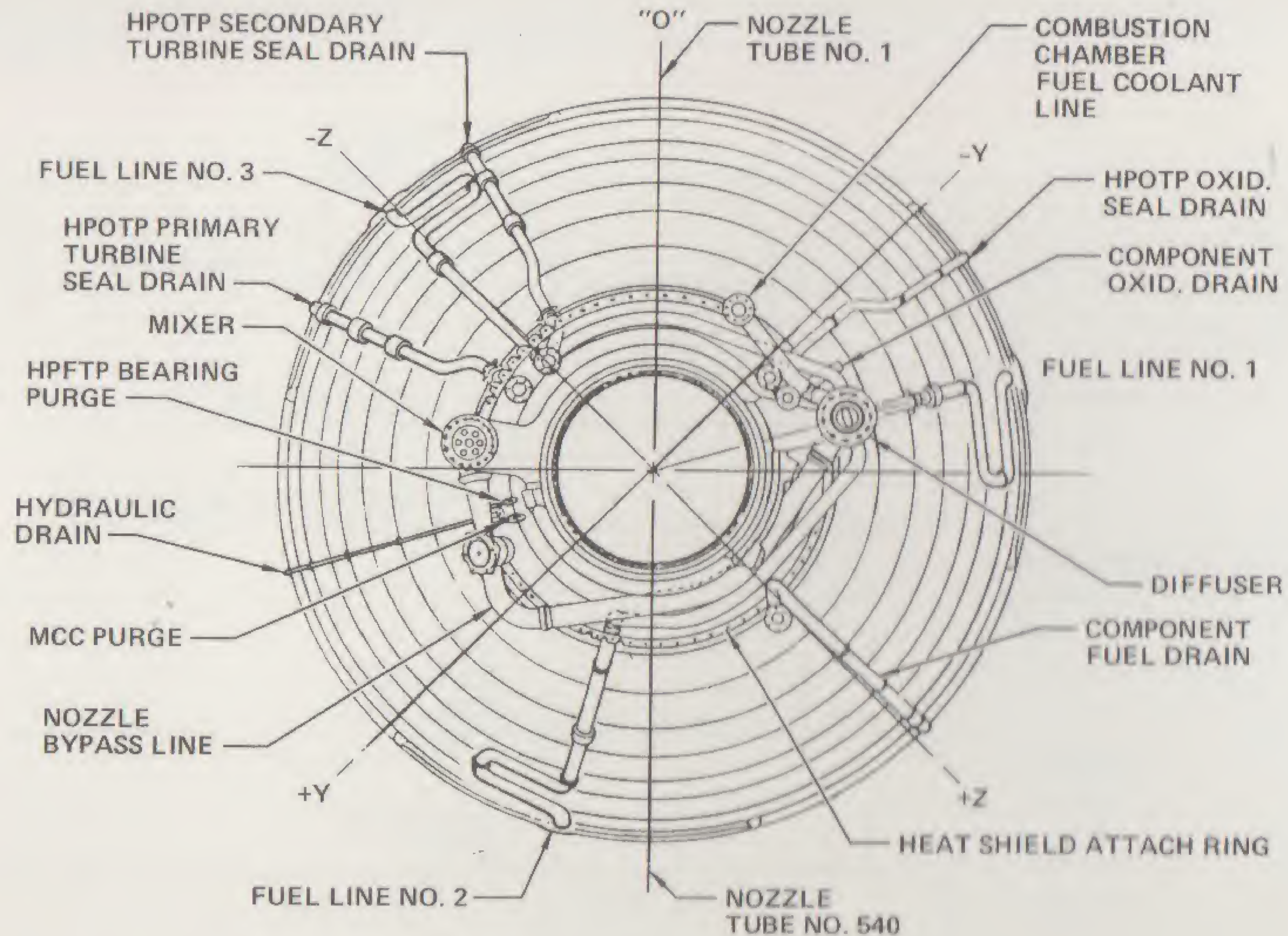


FIGURE 2-20. FLIGHT NOZZLE FEATURES

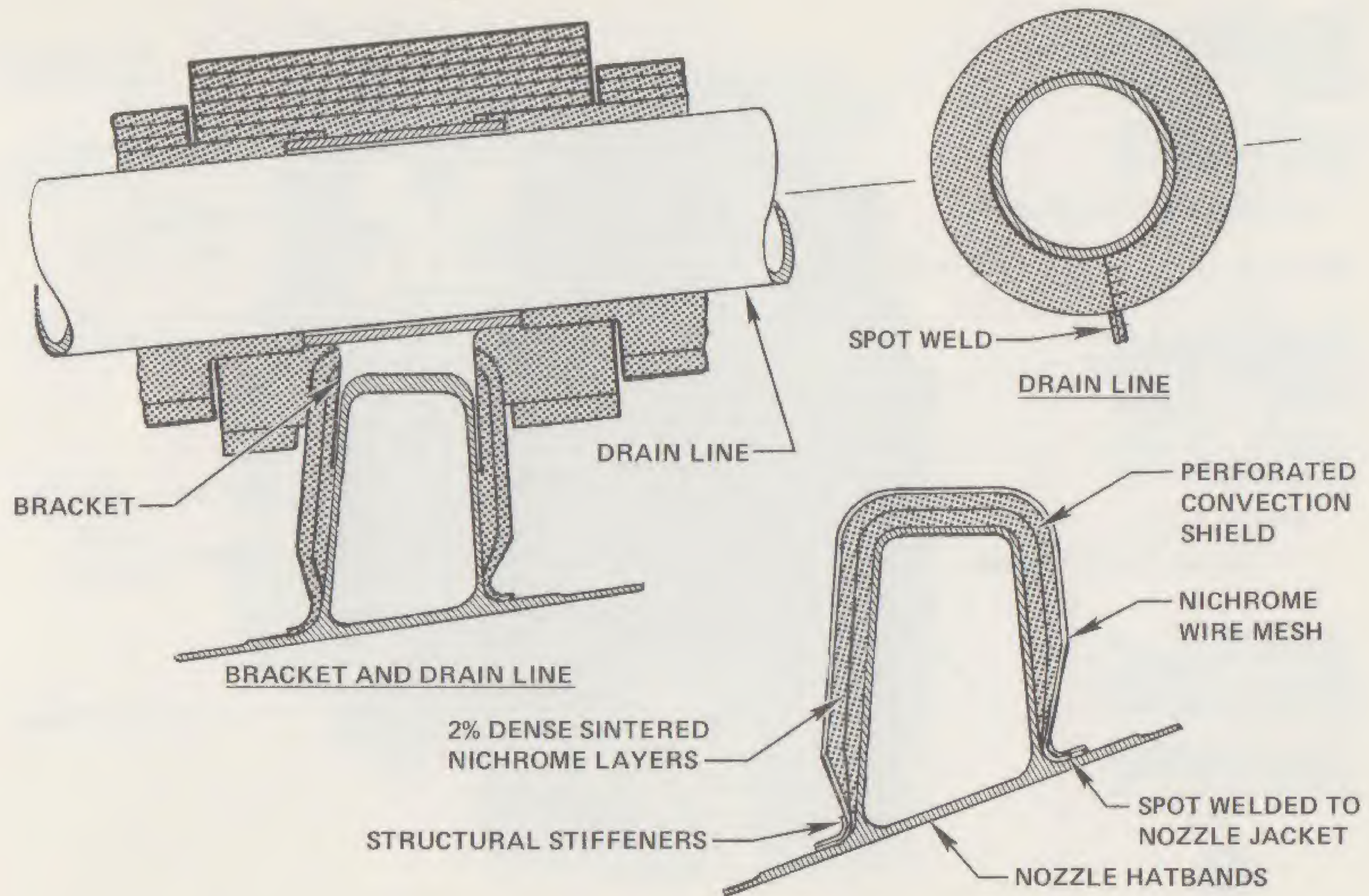


FIGURE 2-21. NOZZLE THERMAL PROTECTION INSULATION CONFIGURATION

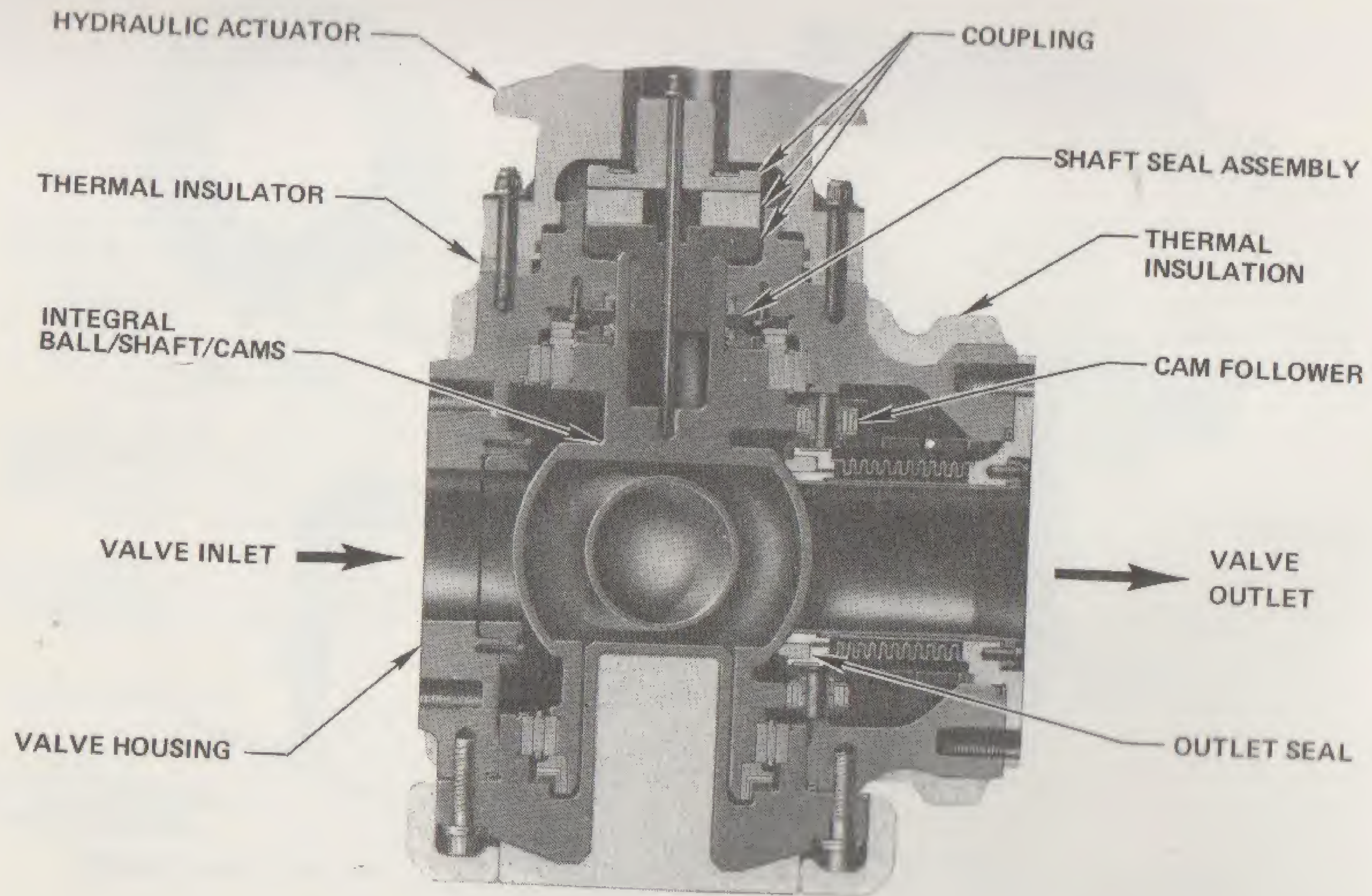
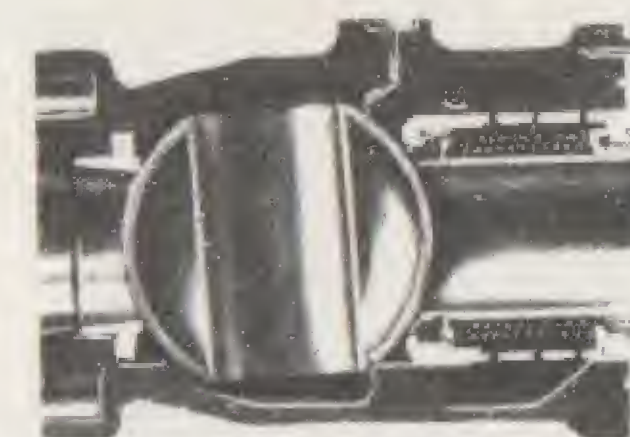
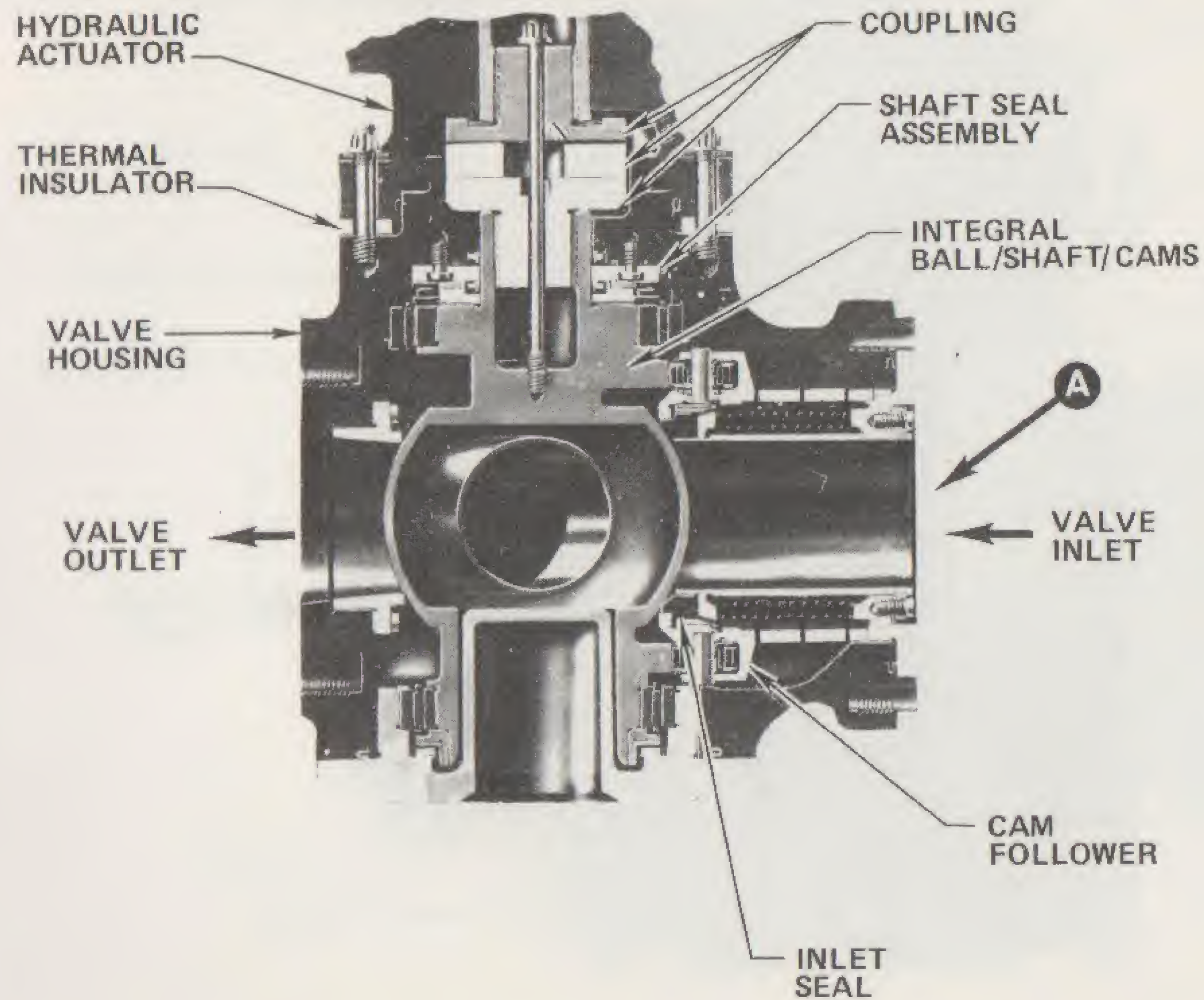
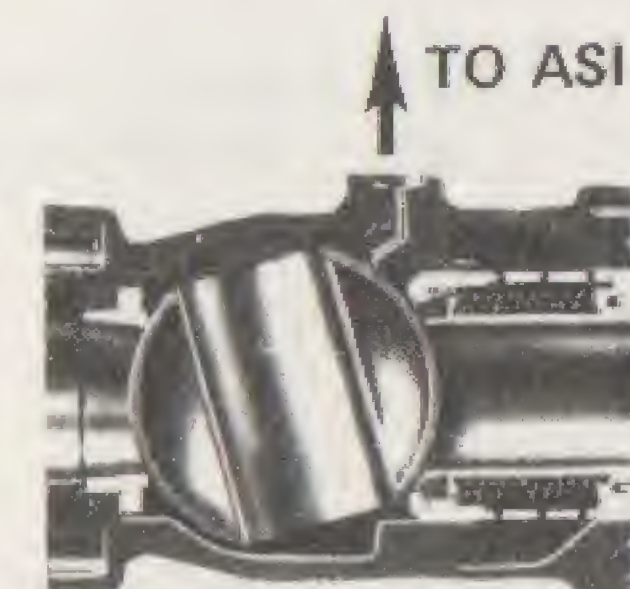


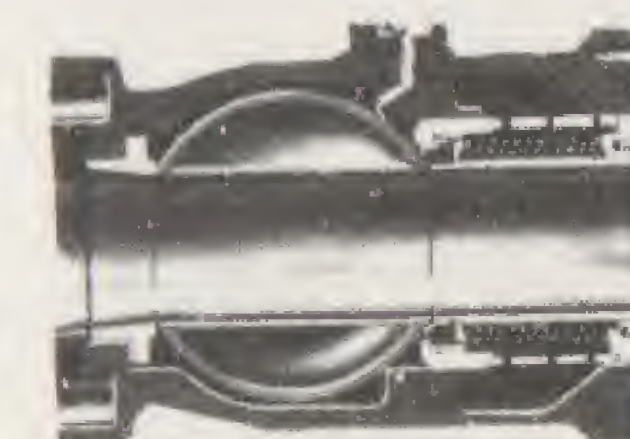
FIGURE 2-22. MAIN FUEL VALVE



CLOSED



SEAL LIFTOFF



OPEN

A

FIGURE 2-23. MAIN OXIDIZER VALVE

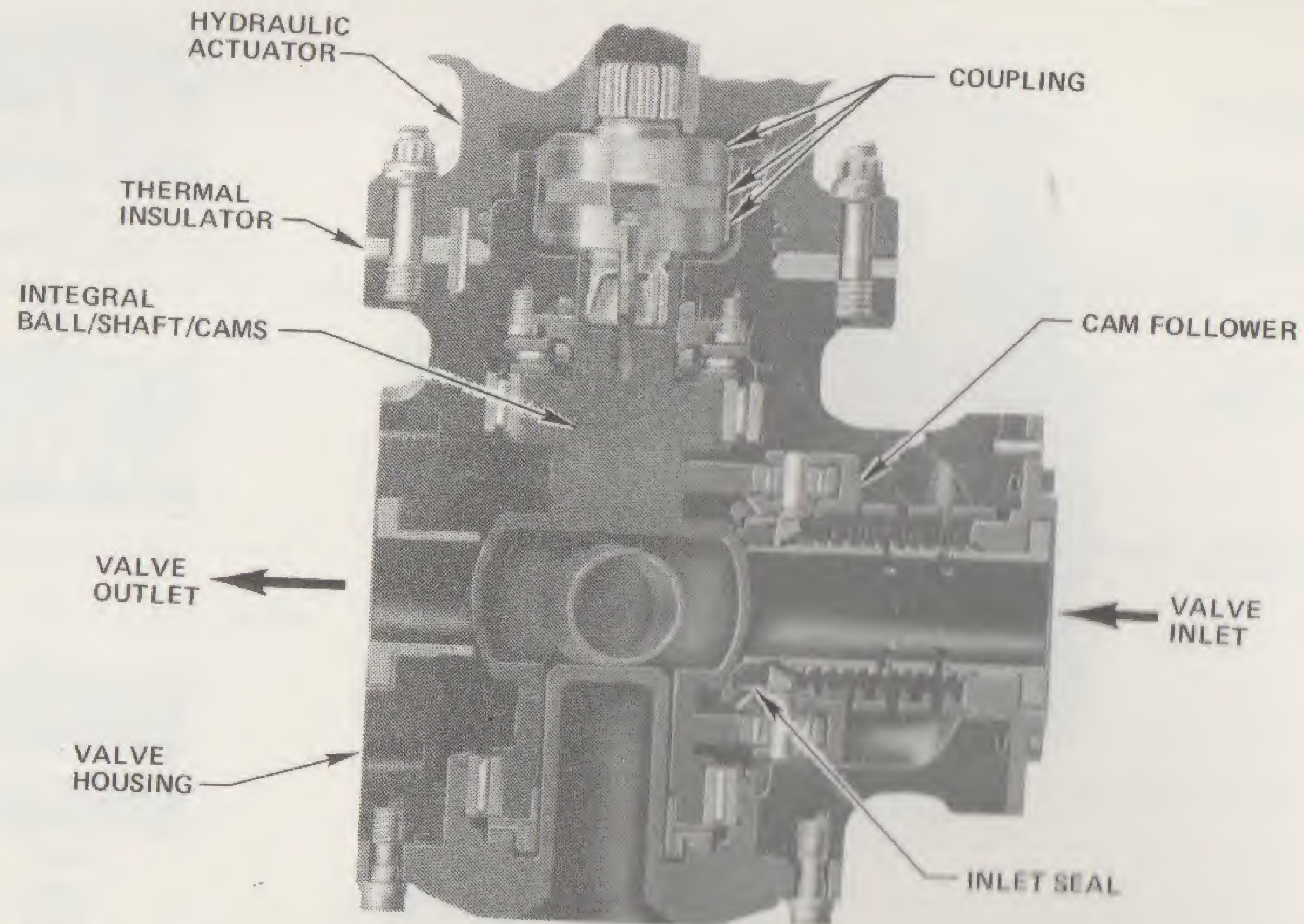


FIGURE 2-24. FUEL PREBURNER OXIDIZER VALVE

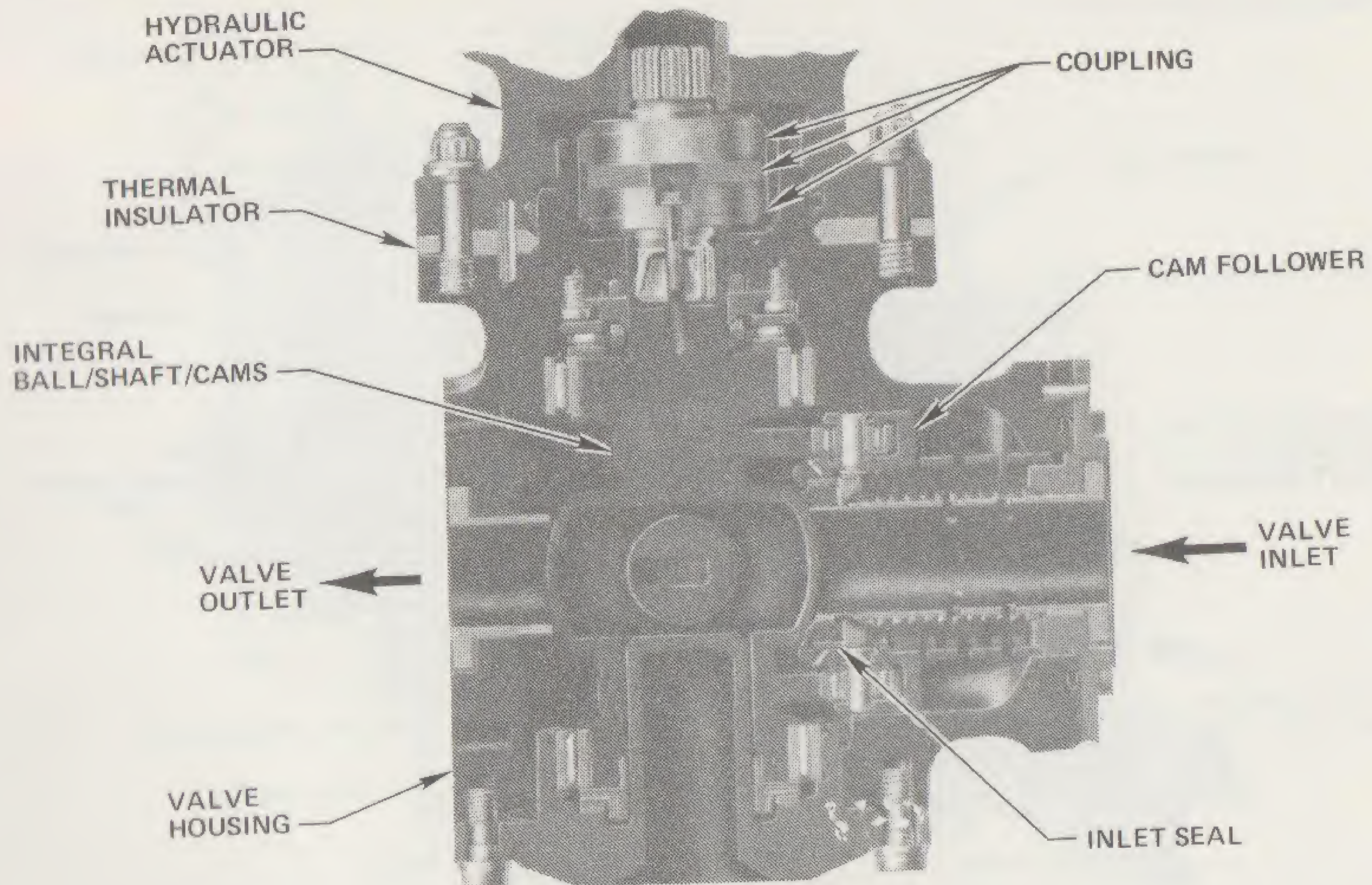


FIGURE 2-25. OXIDIZER PREBURNER OXIDIZER VALVE

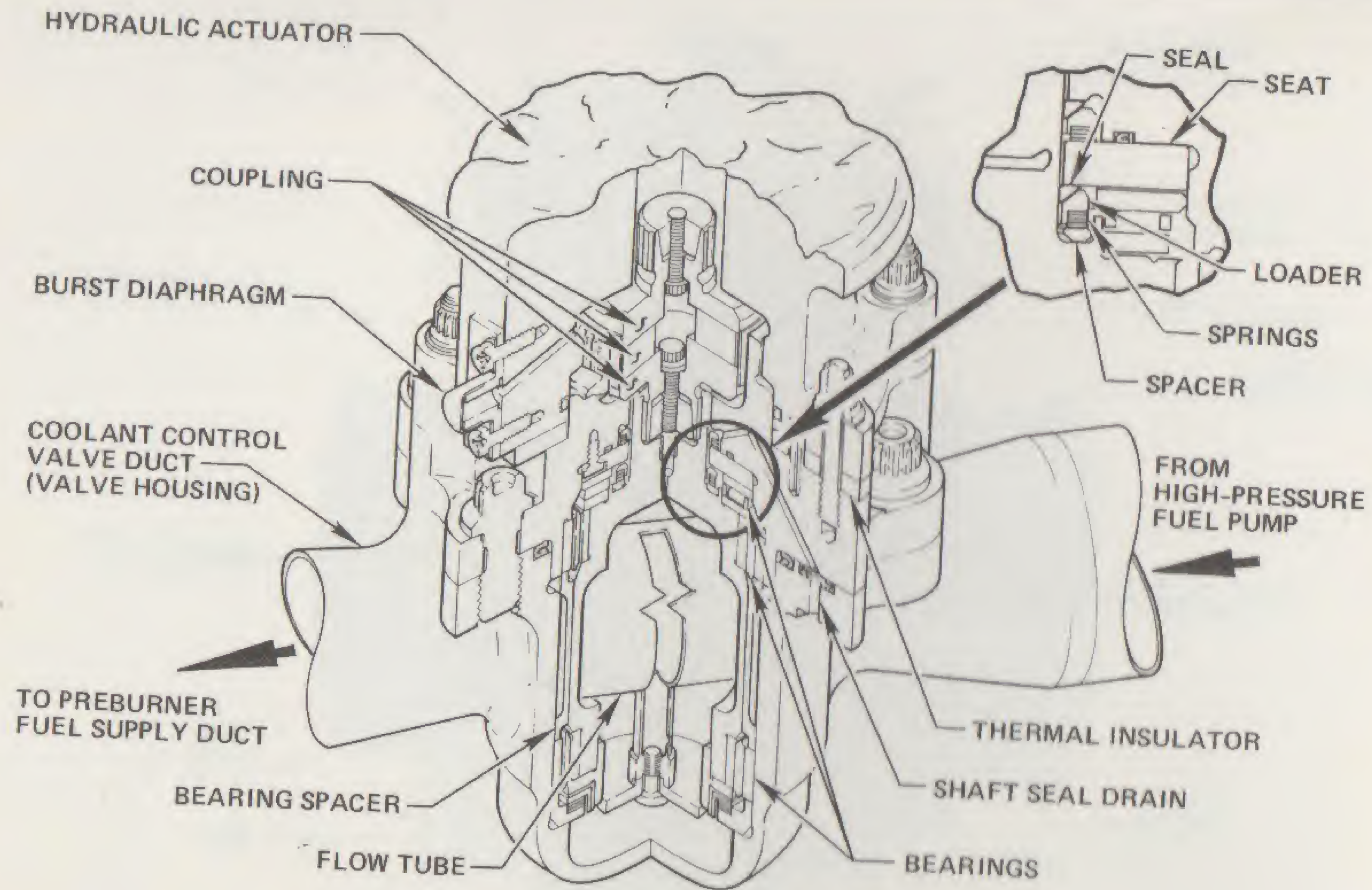


FIGURE 2-26. CHAMBER COOLANT VALVE

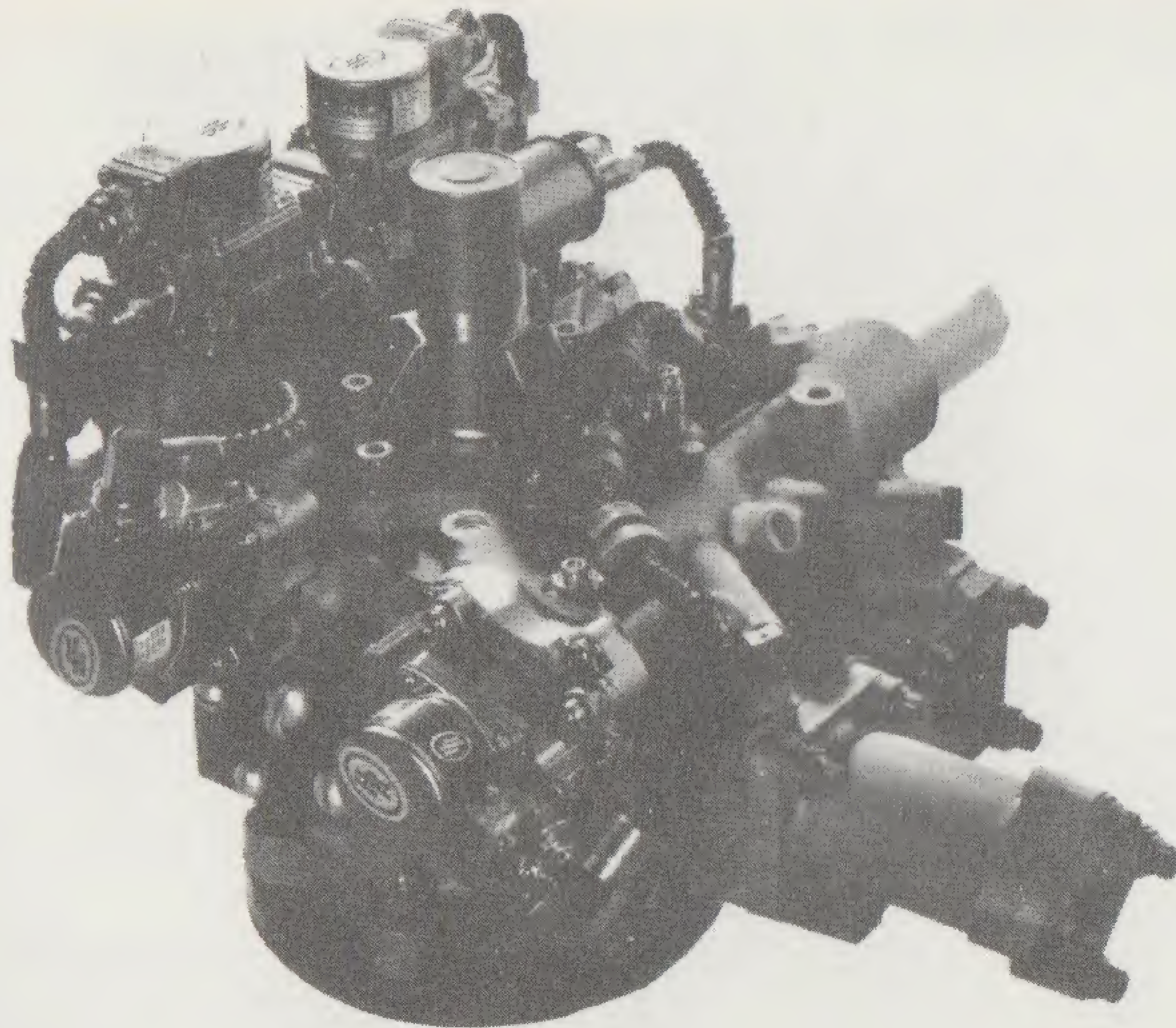


FIGURE 2-27. PROPELLANT VALVE HYDRAULIC ACTUATOR (TYPICAL) (SHEET 1 OF 2)

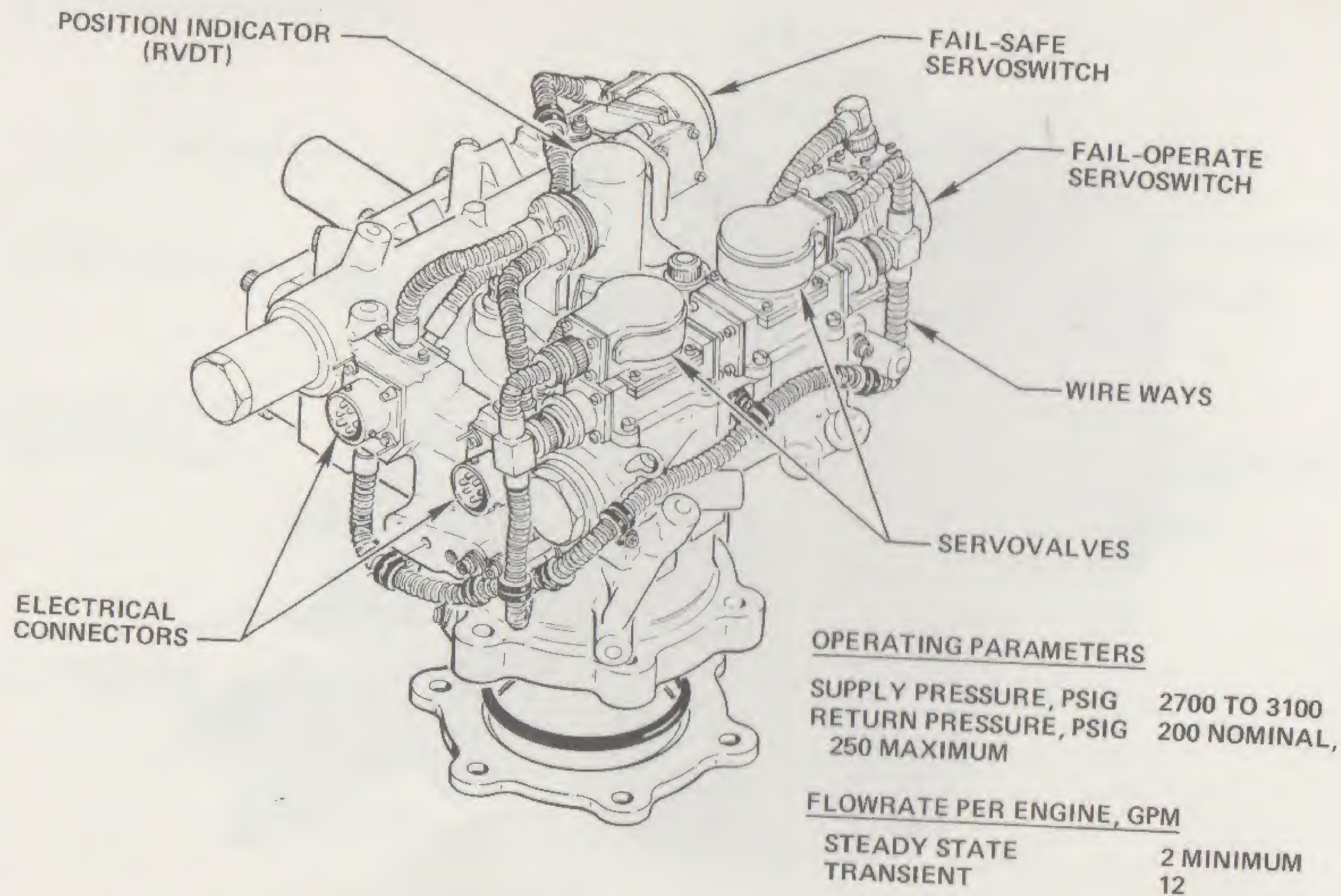


FIGURE 2-27. PROPELLANT VALVE HYDRAULIC ACTUATOR (TYPICAL) (SHEET 2 OF 2)

MAIN FUEL VALVE HYDRAULIC ACTUATOR (MFVA) SCHEMATIC NORMAL FLIGHT CONDITION

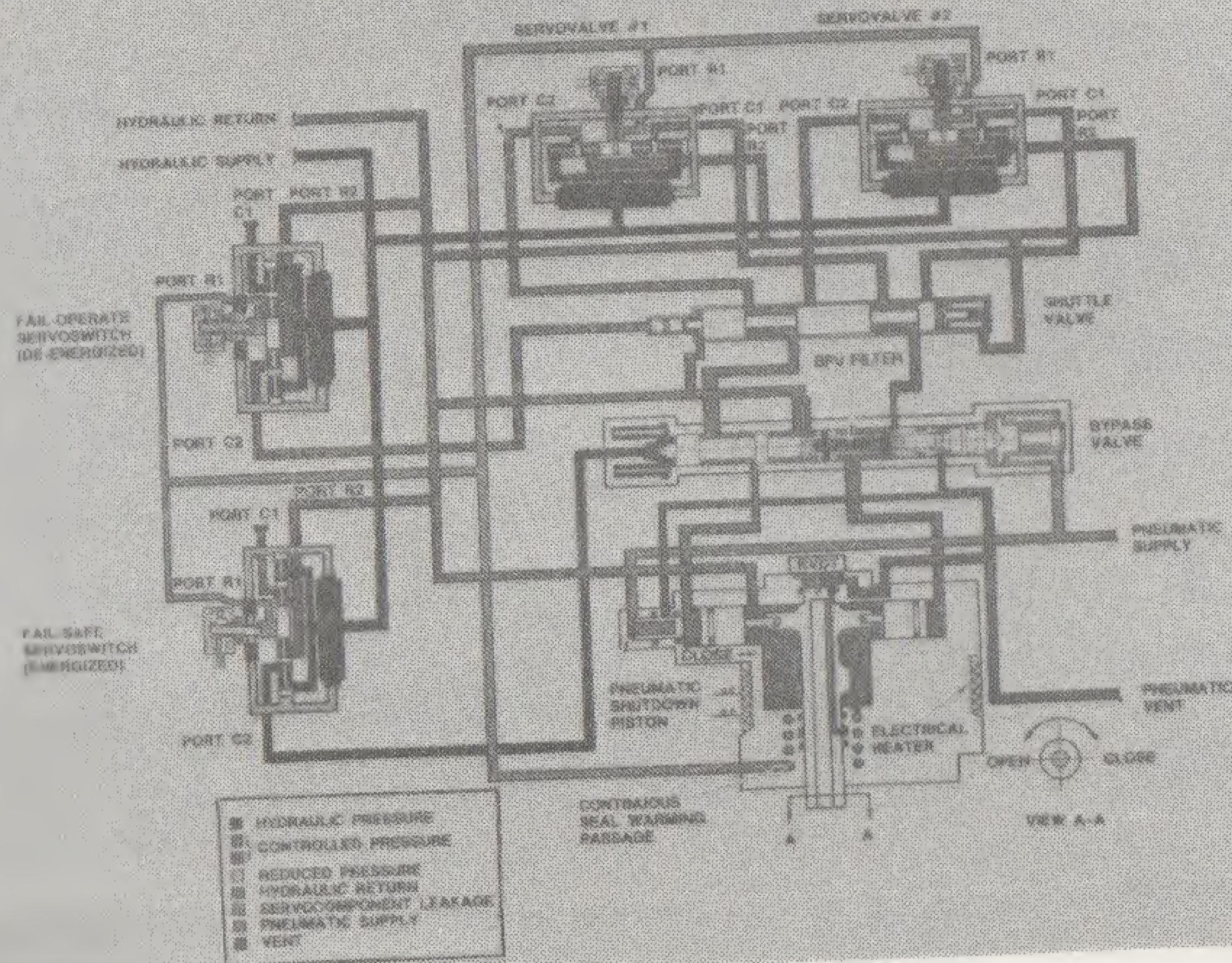


FIGURE 2-28. SSME HYDRAULIC SCHEMATIC

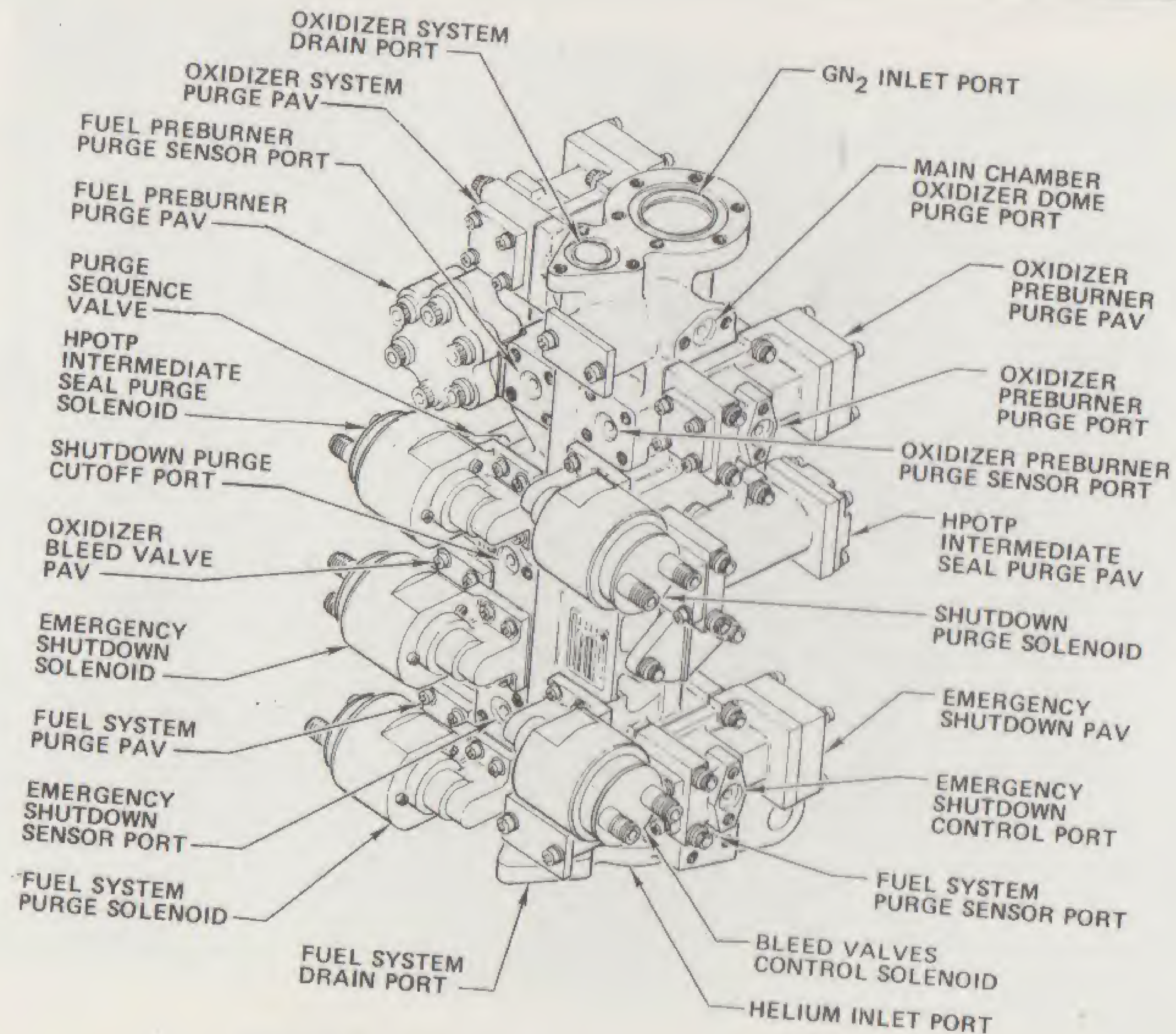


FIGURE 2-29. PNEUMATIC CONTROL ASSEMBLY

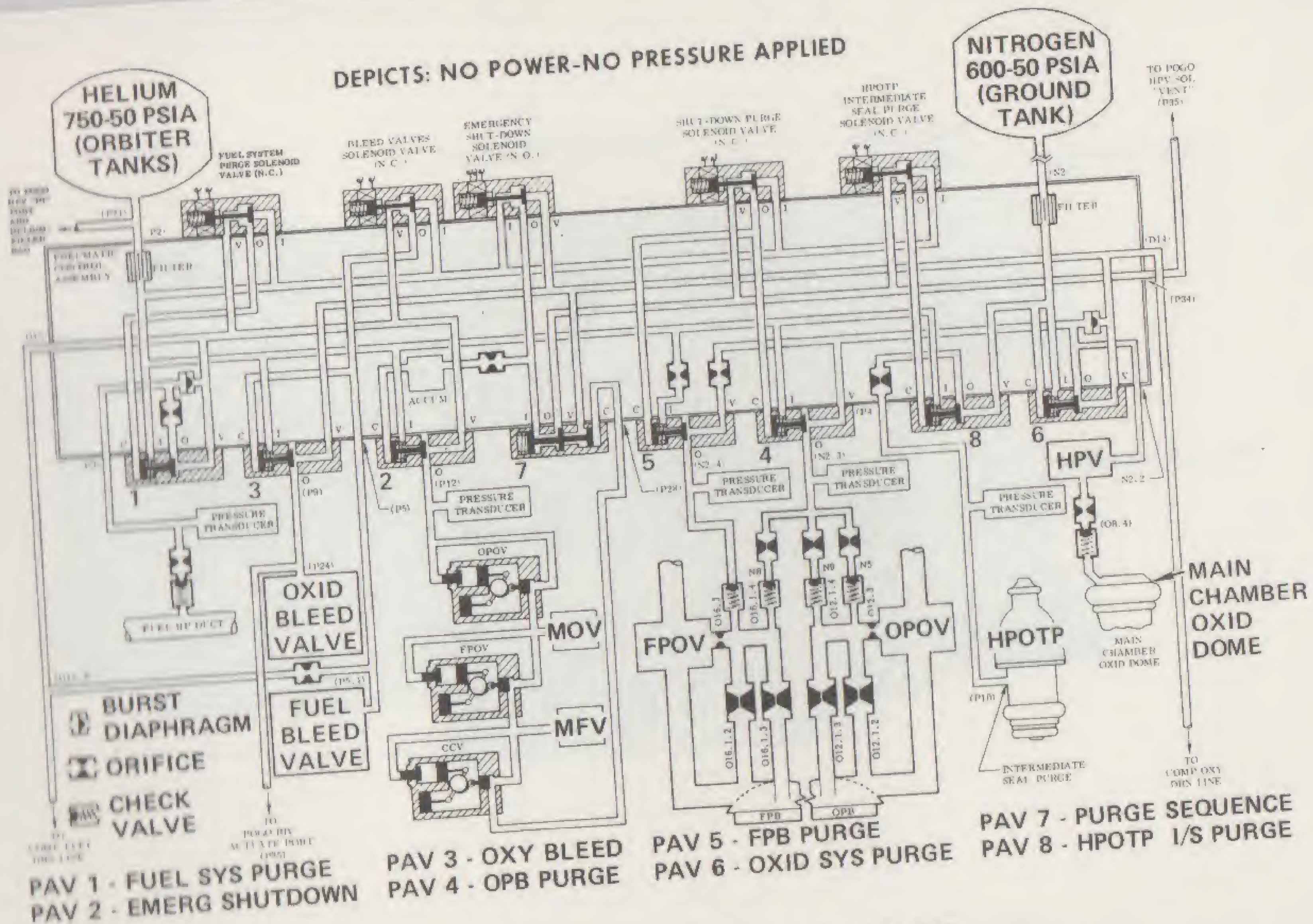


FIGURE 2-30. SSME PNEUMATIC SCHEMATIC

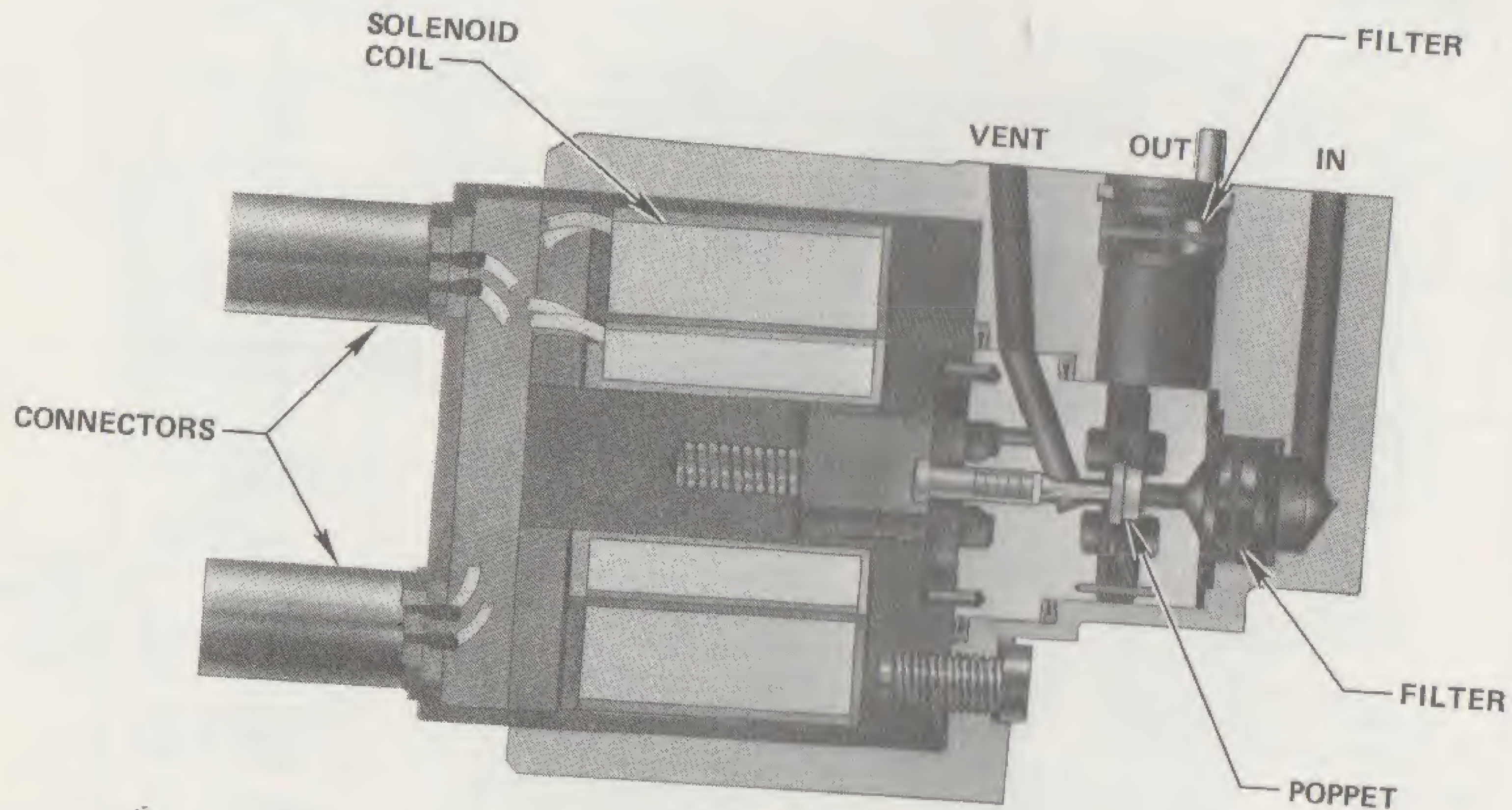


FIGURE 2-31. NORMALLY CLOSED DUAL COIL SOLENOID VALVE

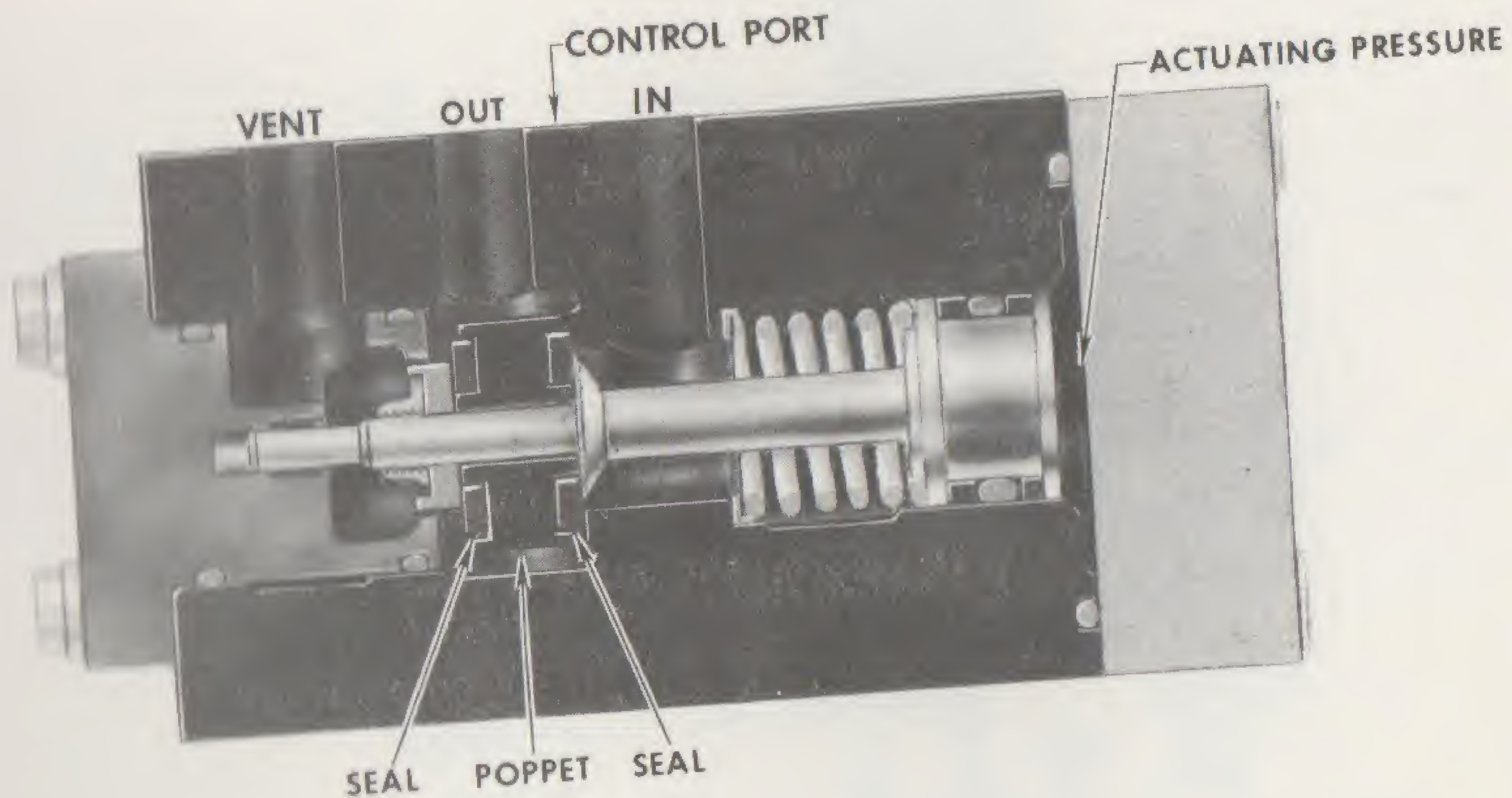


FIGURE 2-32. PRESSURE ACTUATED VALVE

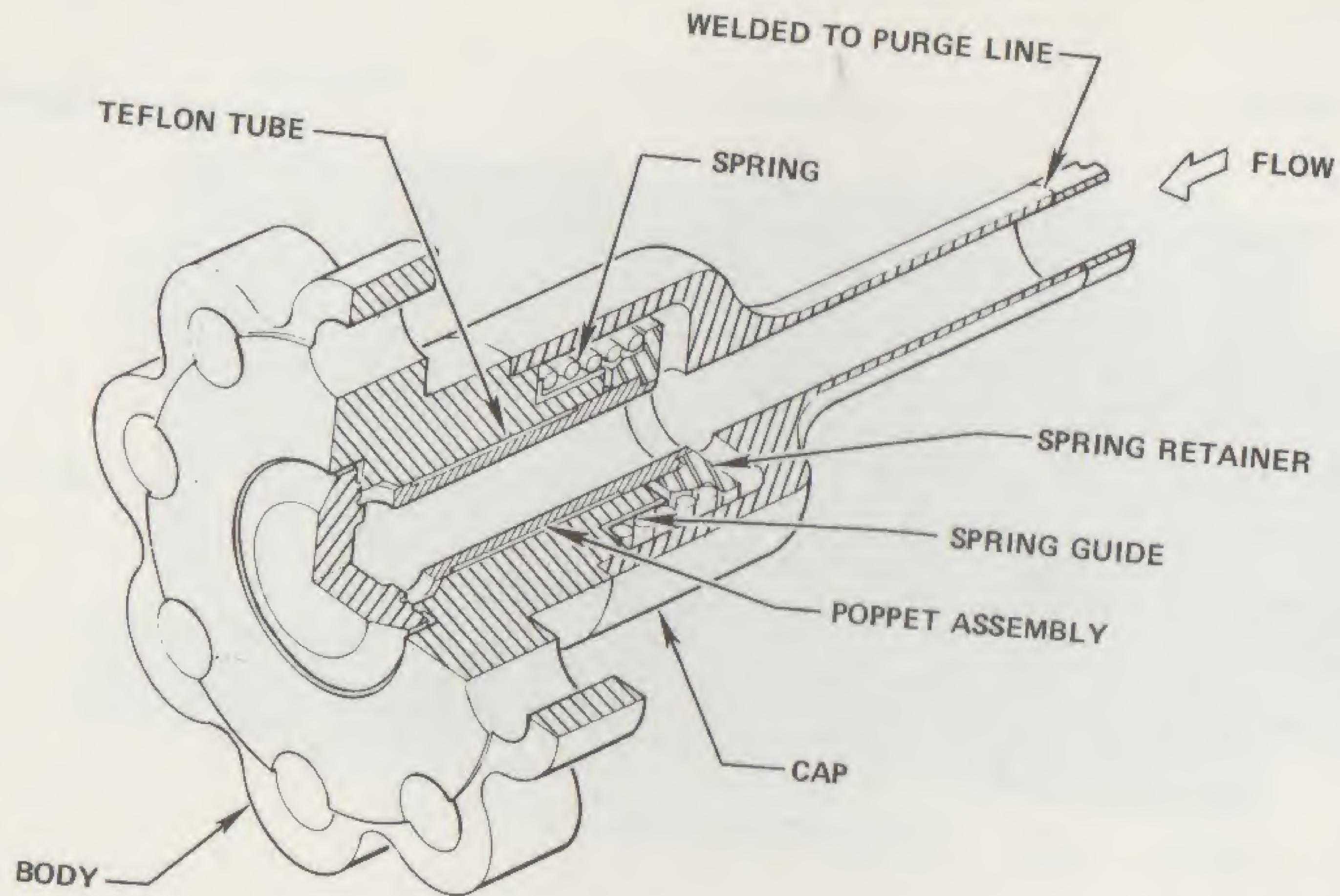


FIGURE 2-33. PURGE CHECK VALVES

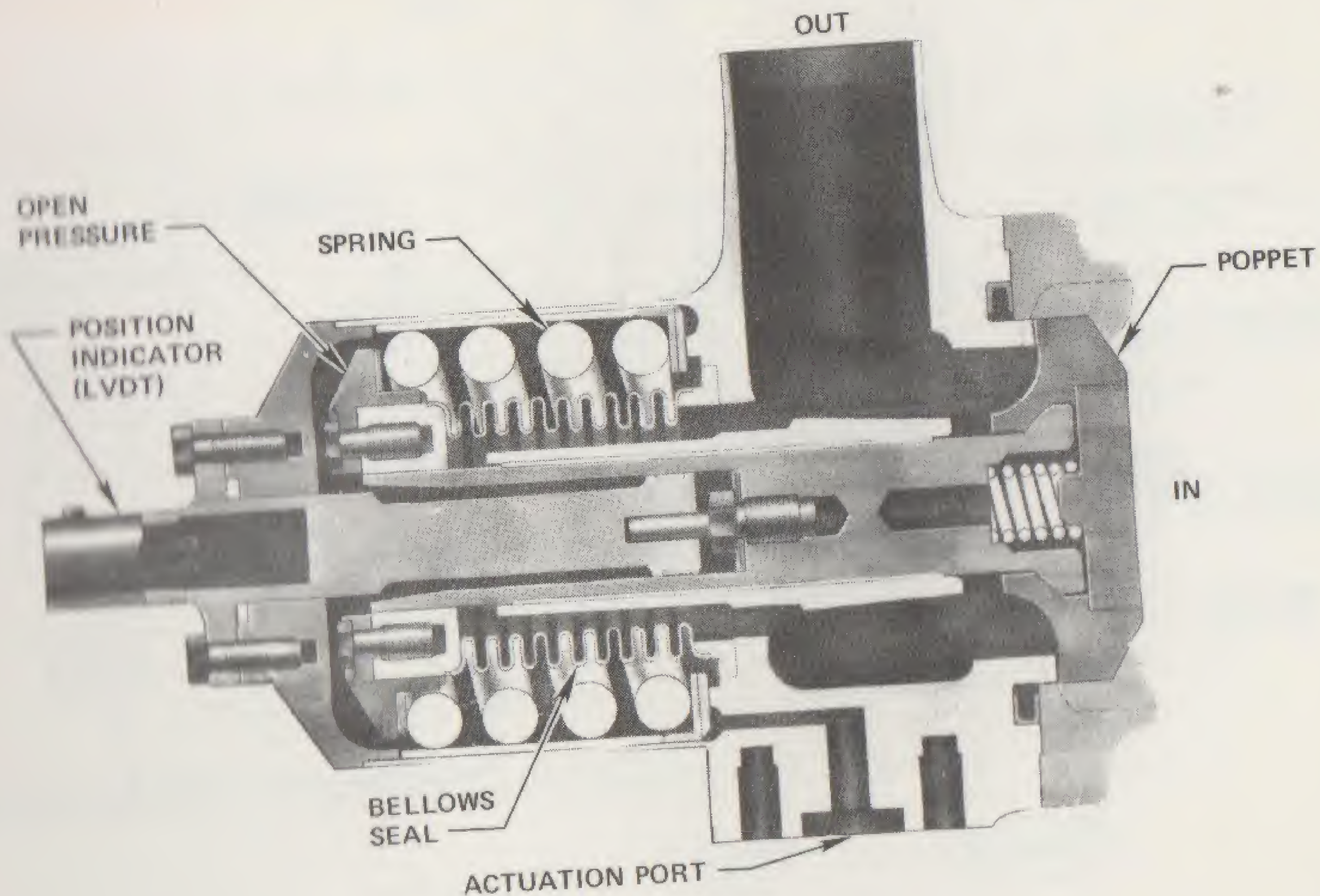


FIGURE 2-34. PROPELLANT BLEED VALVE

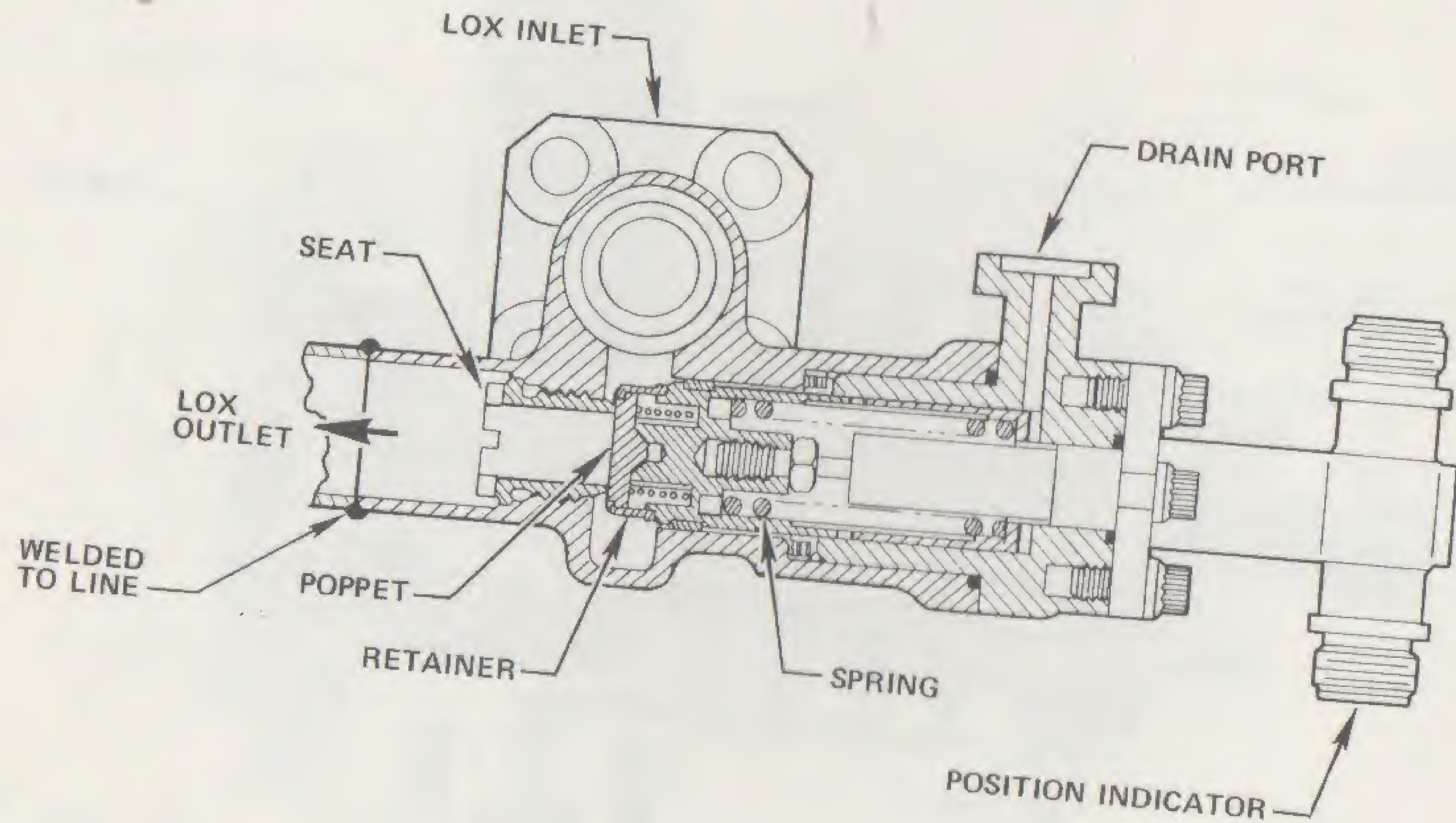


FIGURE 2-35. ANTI-FLOOD VALVE

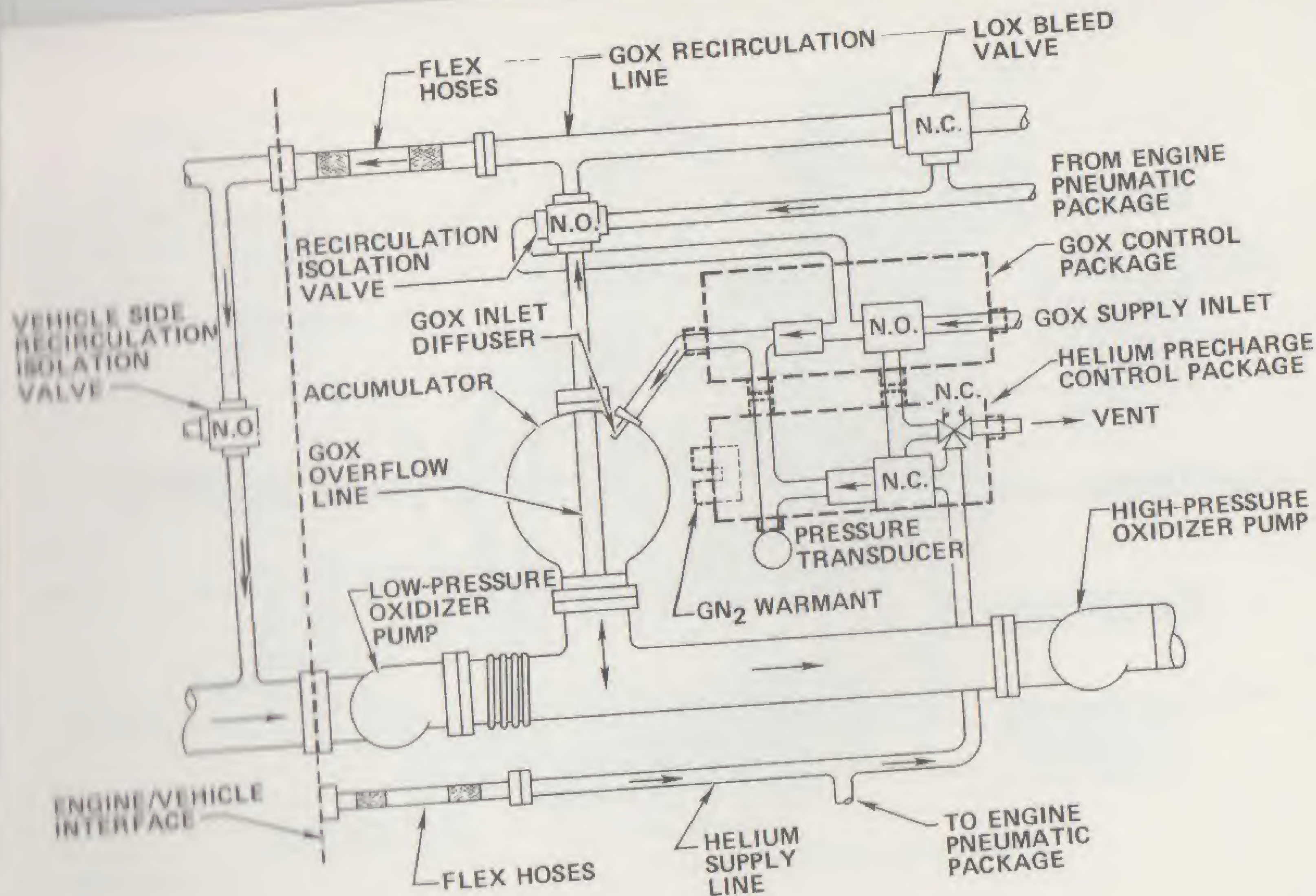


FIGURE 2-36. POGO SUPPRESSION SYSTEM SCHEMATIC

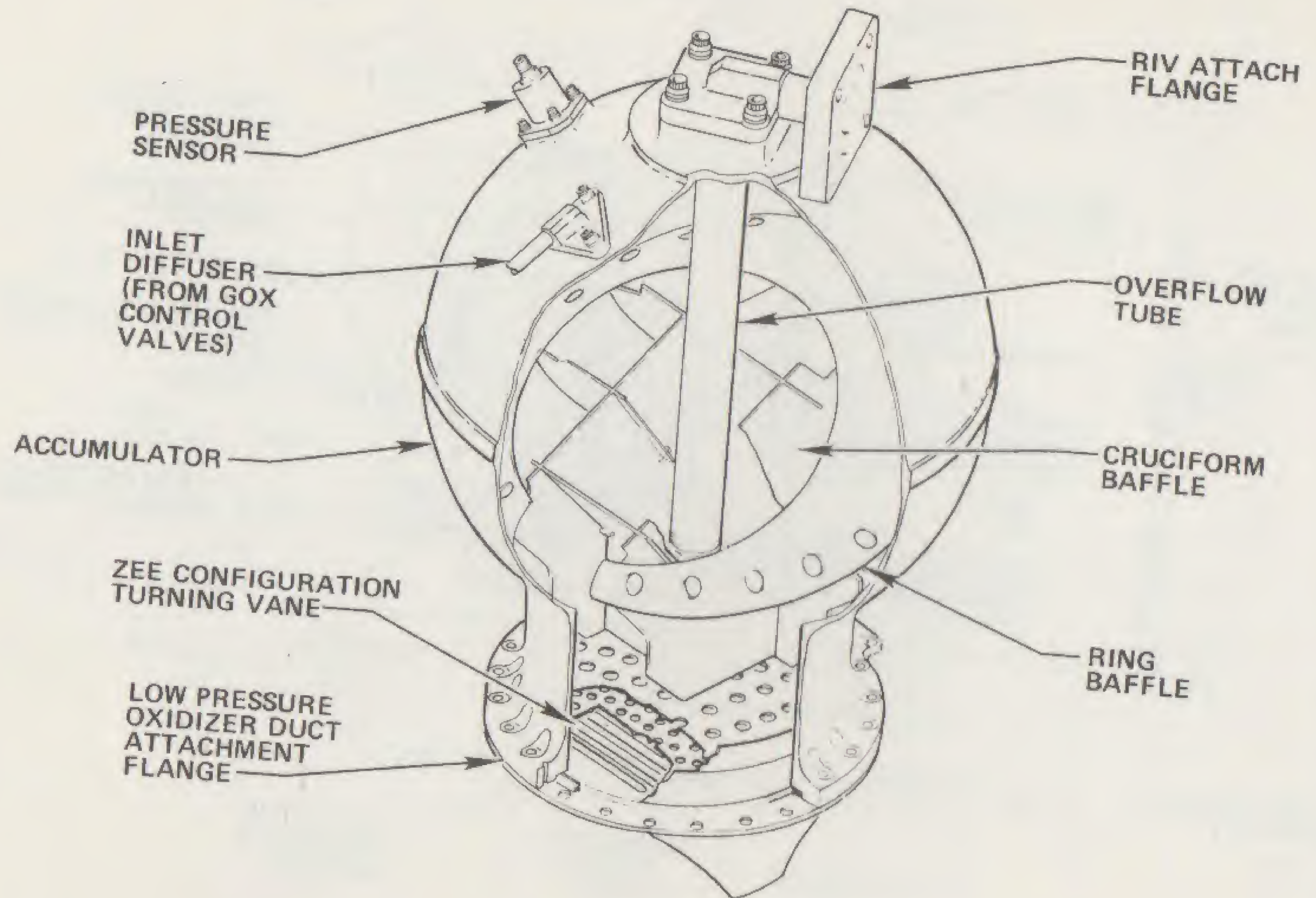


FIGURE 2-37. POGO SUPPRESSOR ACCUMULATOR

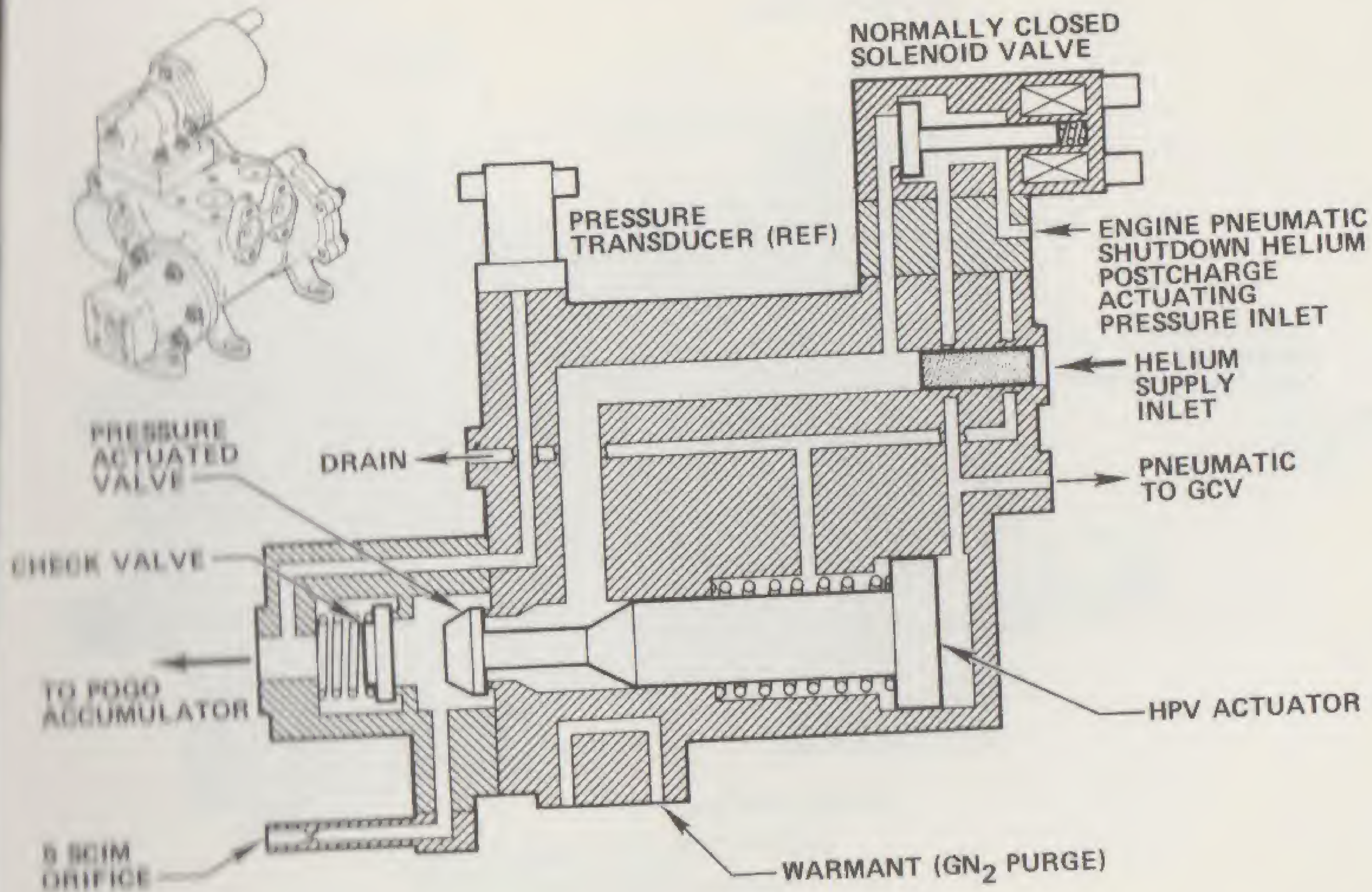


FIGURE 2-38. HELIUM PRECHARGE VALVE

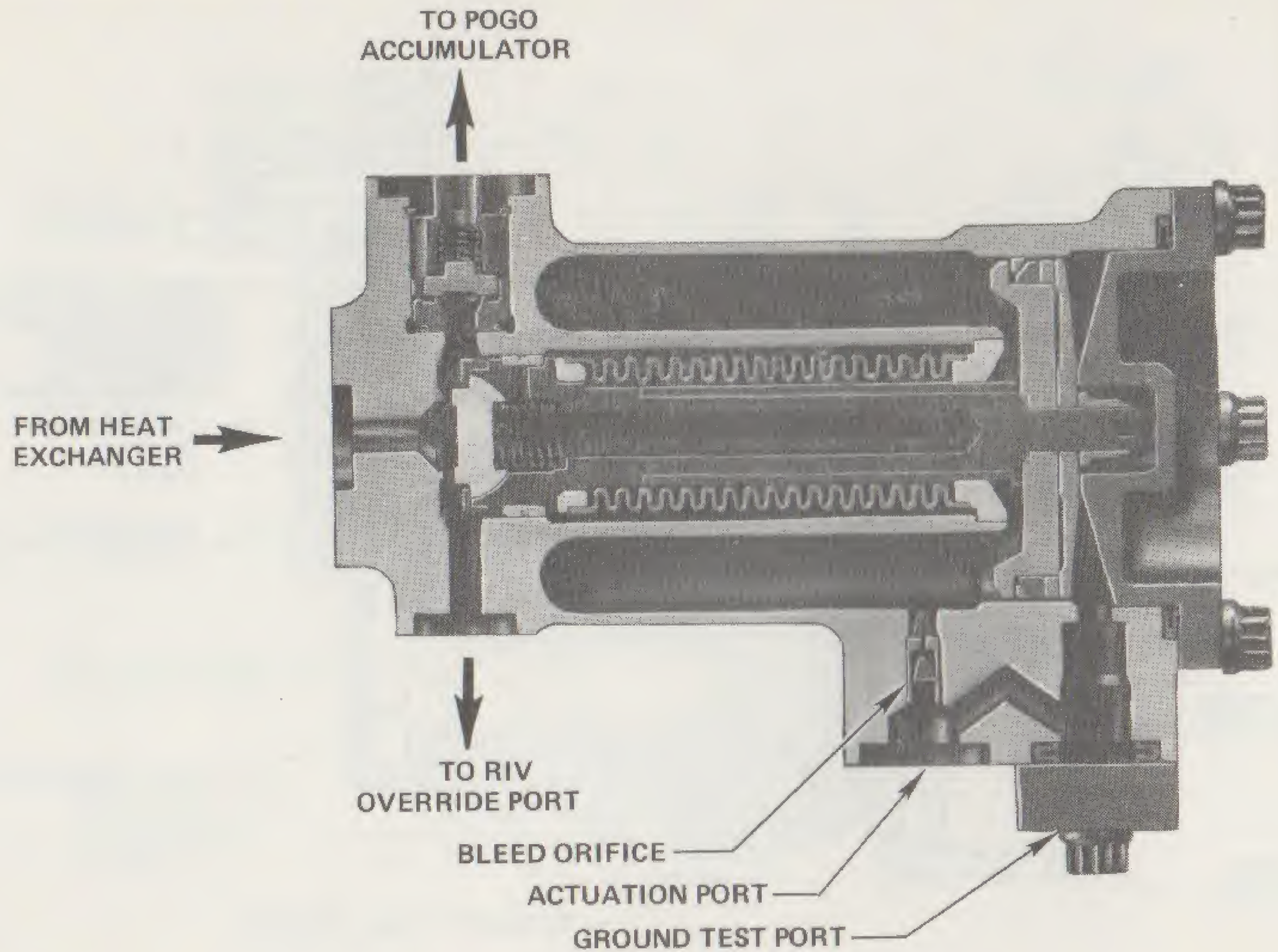


FIGURE 2-39. GASEOUS OXYGEN CONTROL VALVE

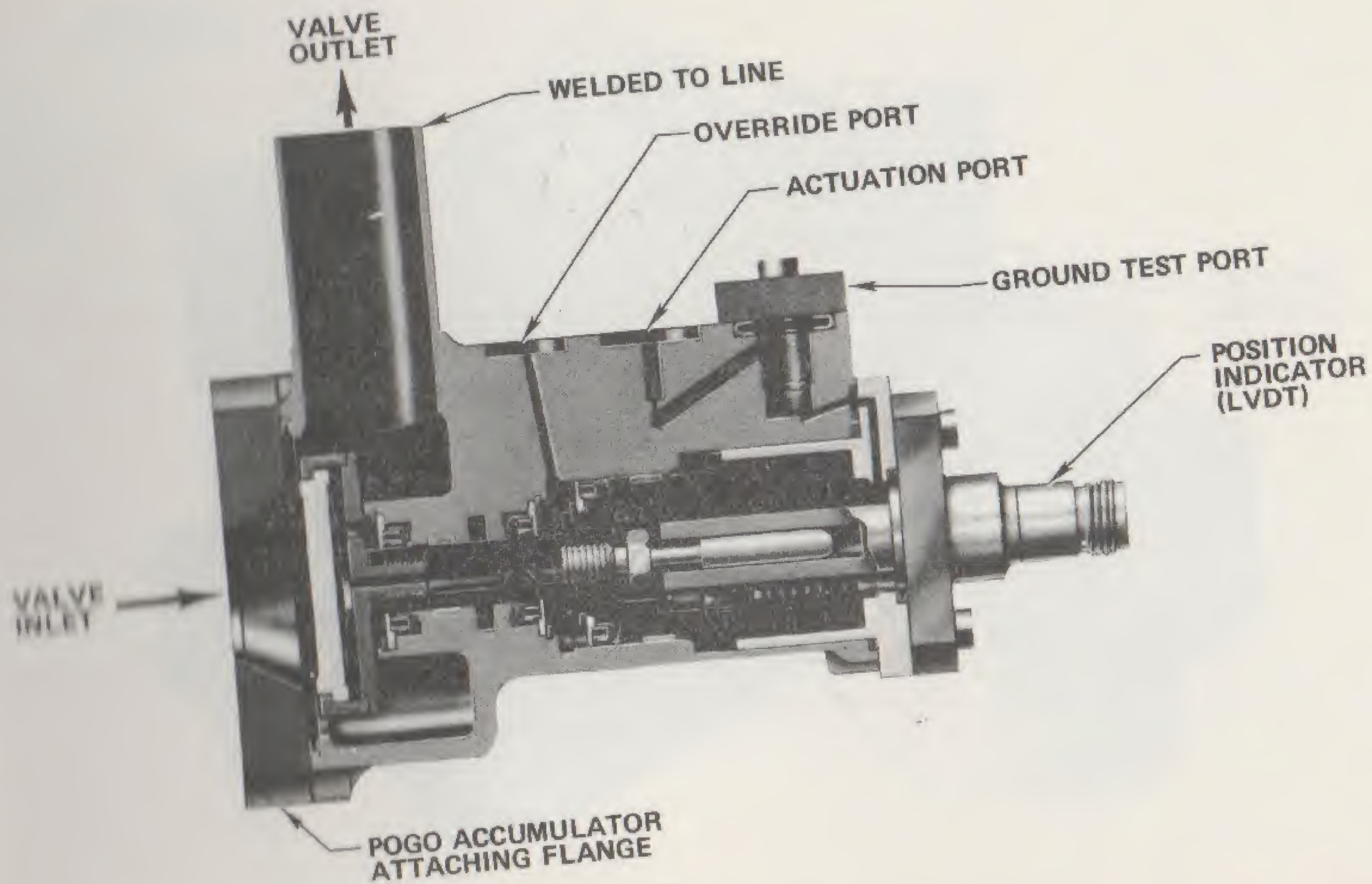


FIGURE 2-40. RECIRCULATION ISOLATION VALVE

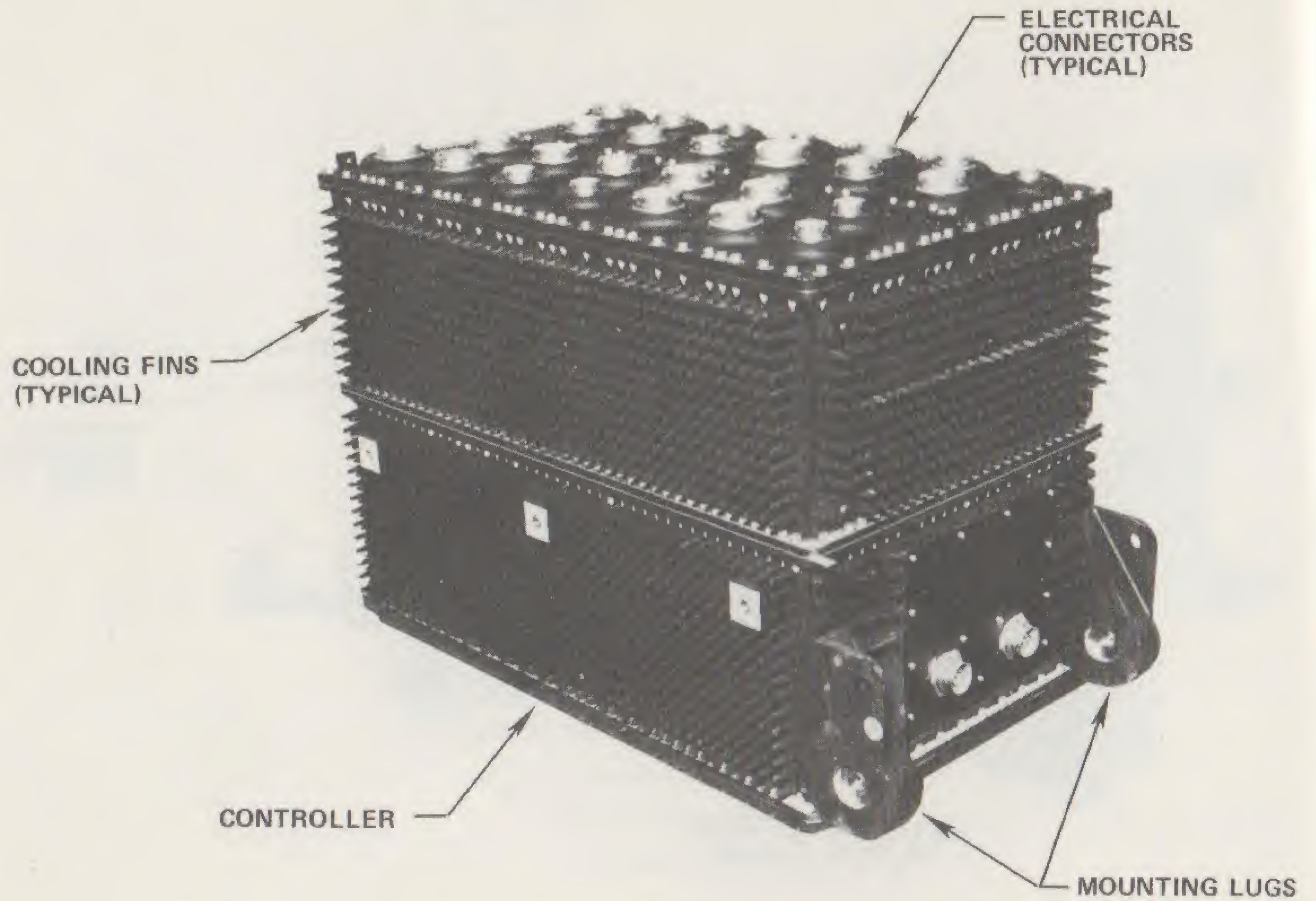


FIGURE 2-41. CONTROLLER

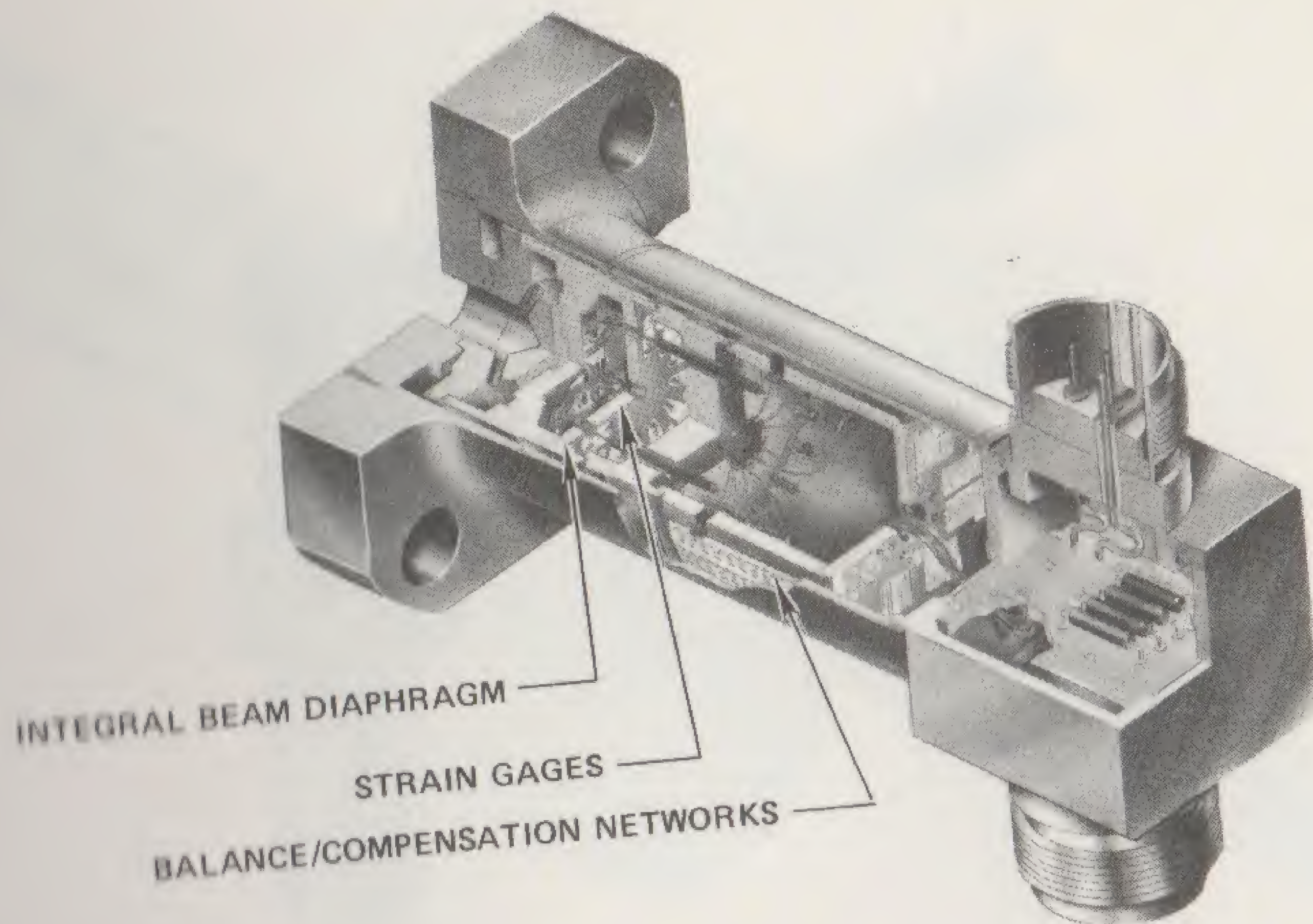


FIGURE 2-42. SSME PRESSURE TRANSDUCER

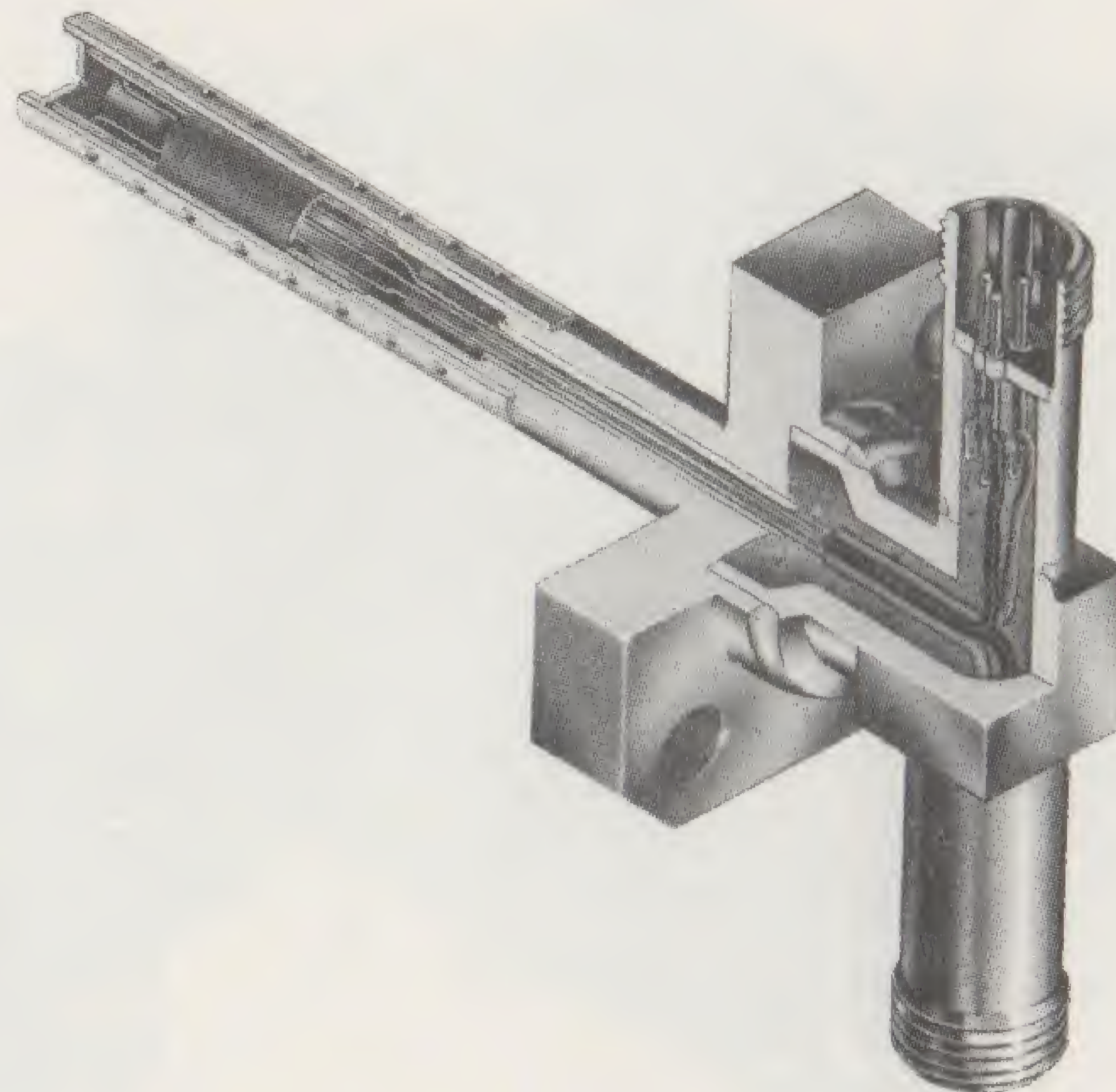


FIGURE 2-43. CRYOGENIC TEMPERATURE SENSOR

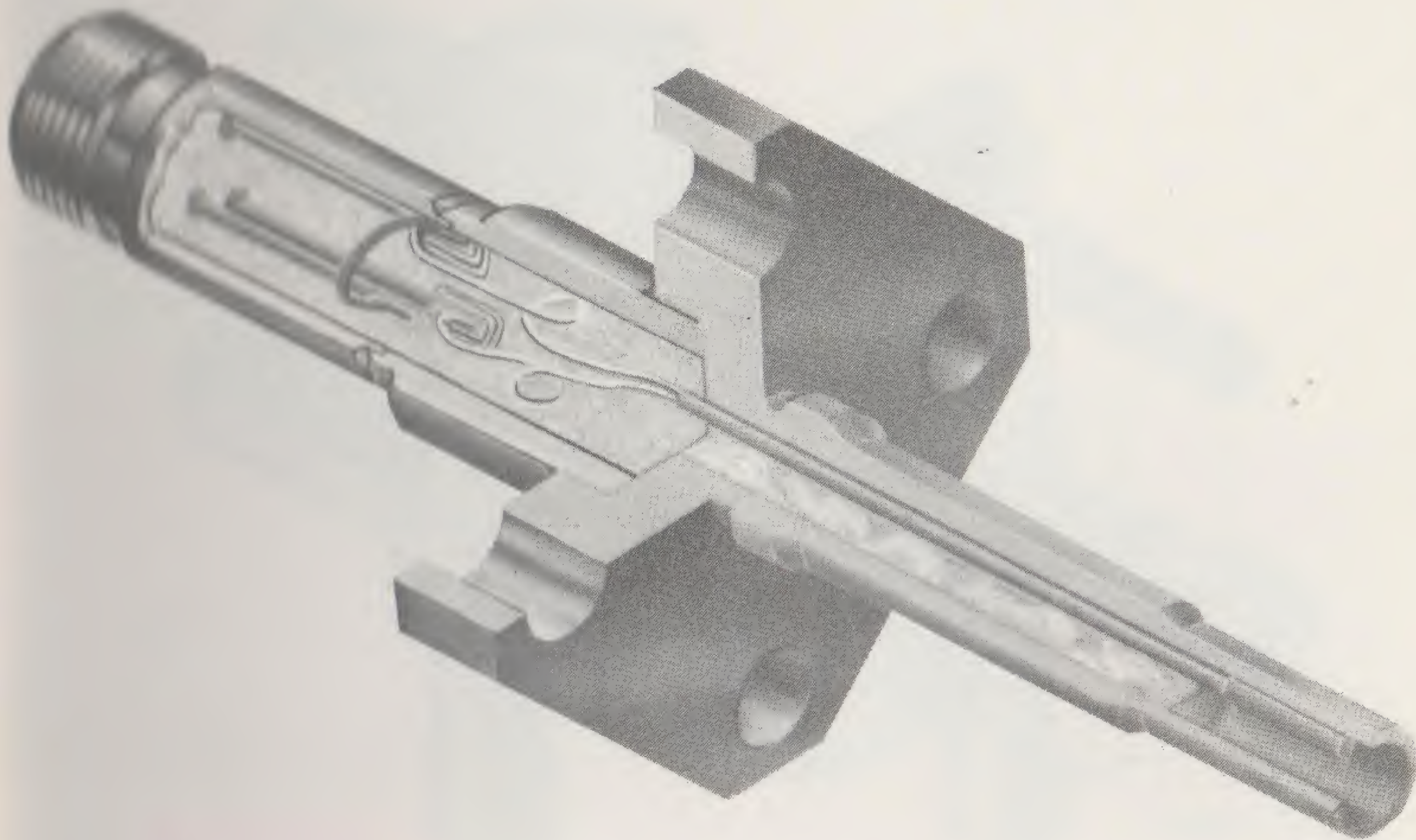


FIGURE 2-44. HOT-GAS TEMPERATURE SENSOR

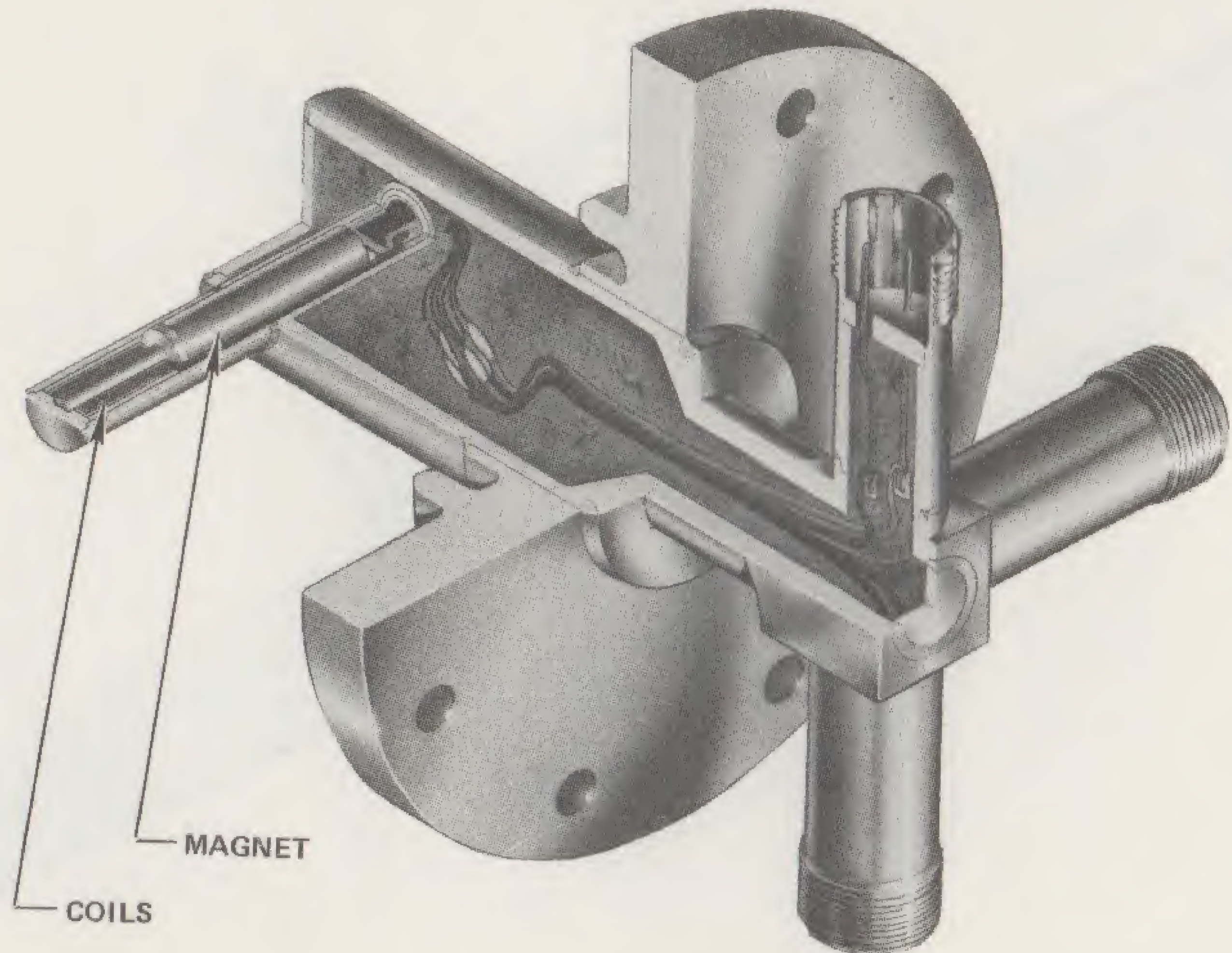


FIGURE 2-45. LPOTP SPEED SENSOR

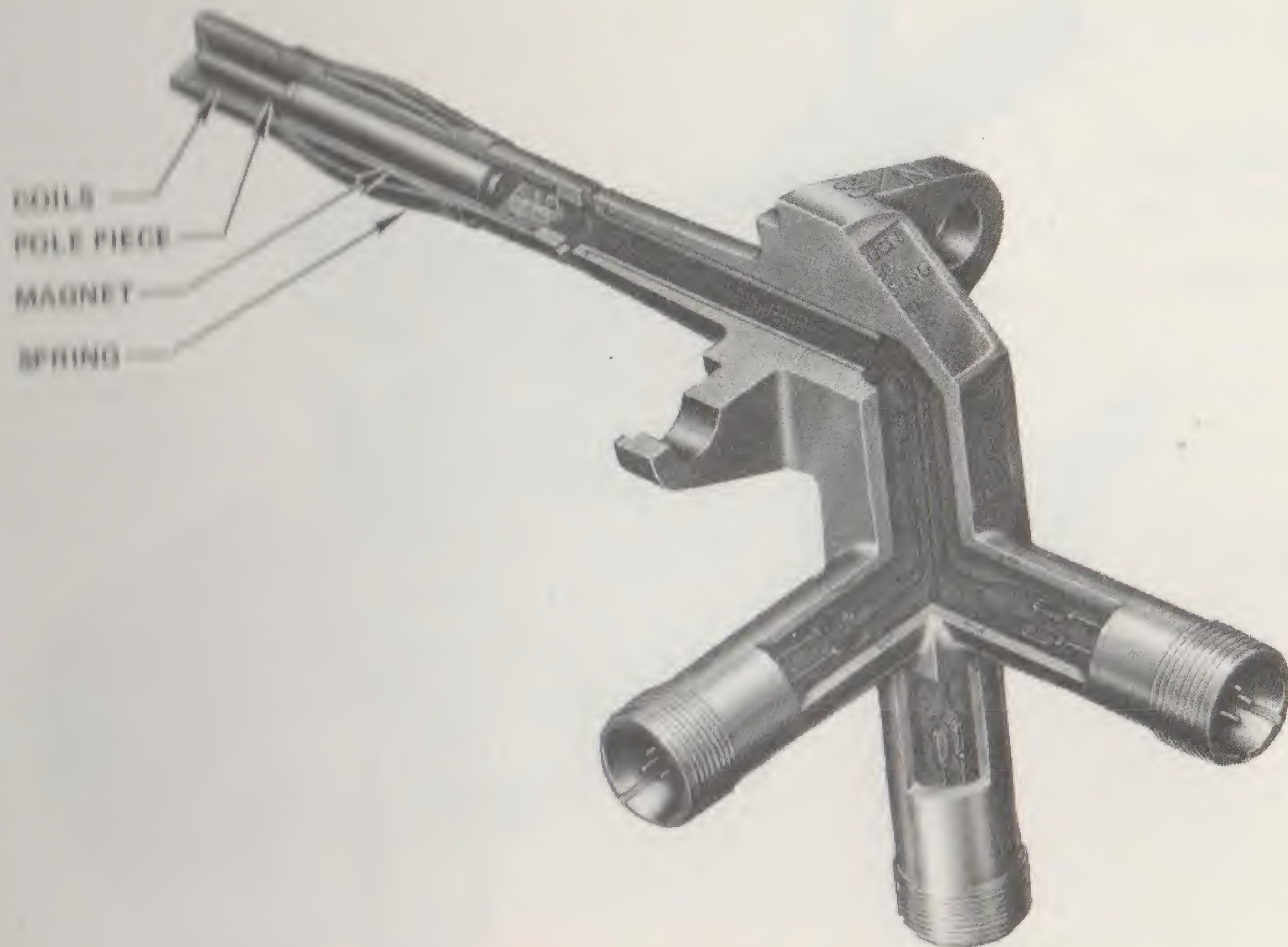


FIGURE 2-46. LPFTP SPEED SENSOR

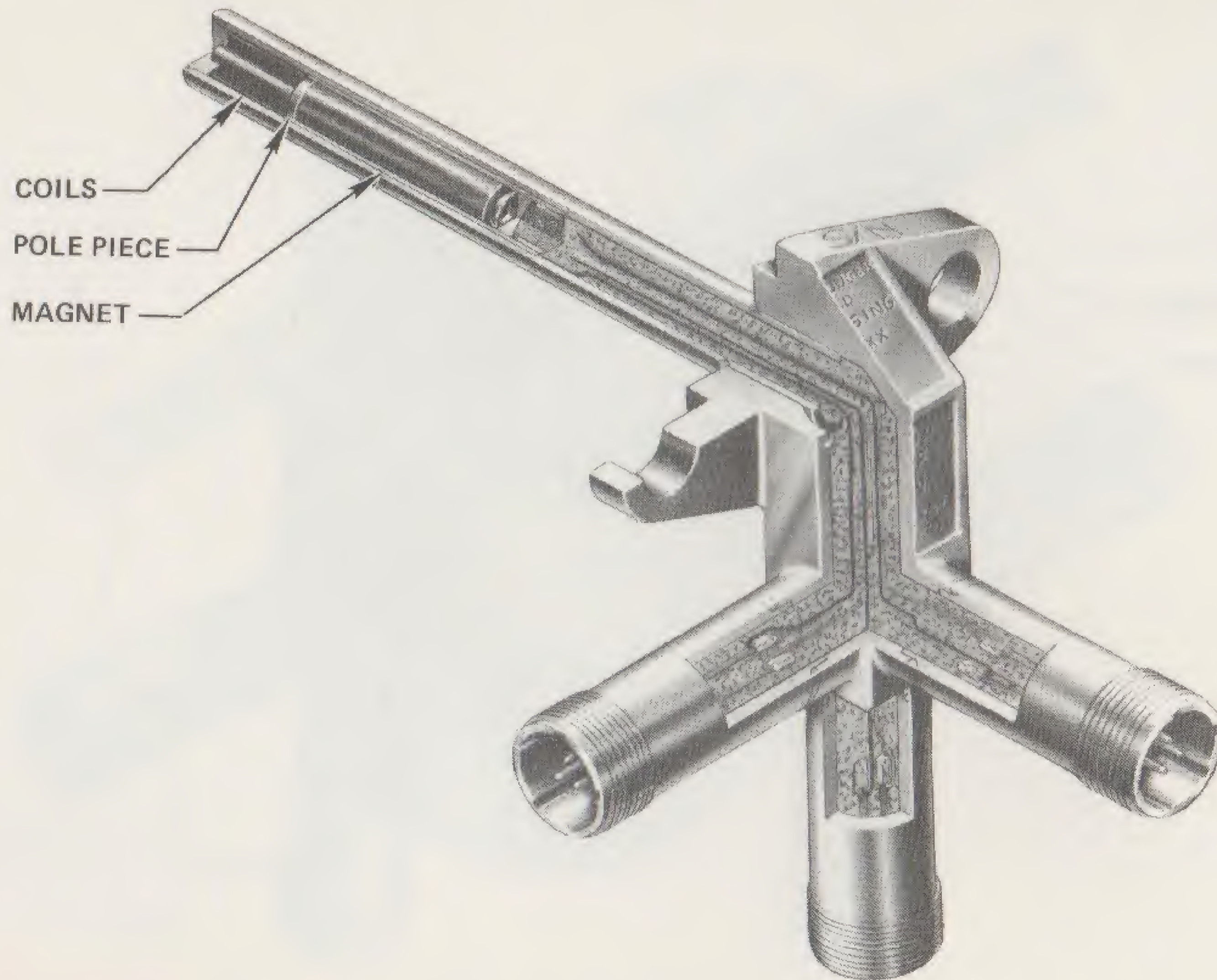


FIGURE 2-47. HPFTP SPEED SENSOR

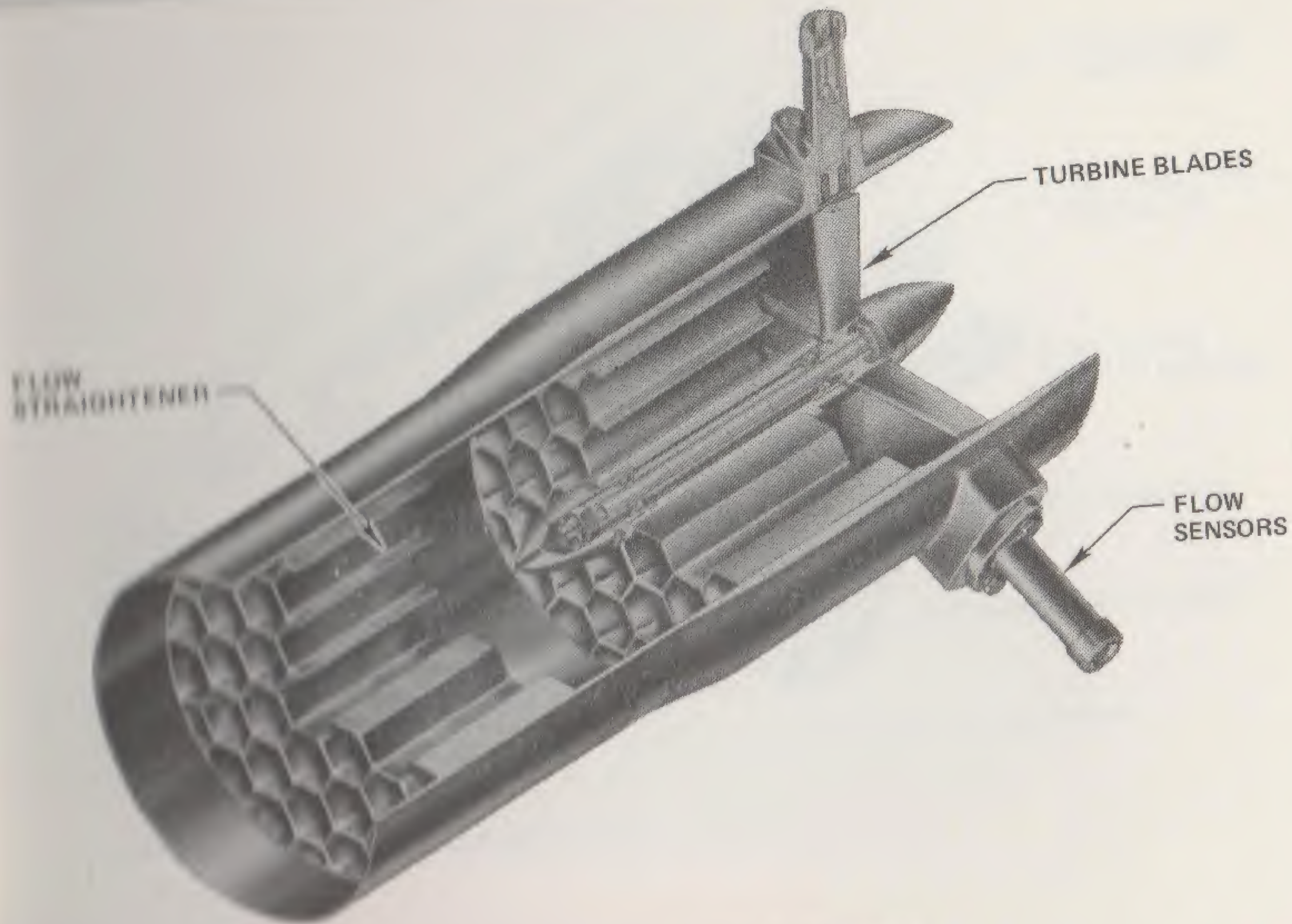
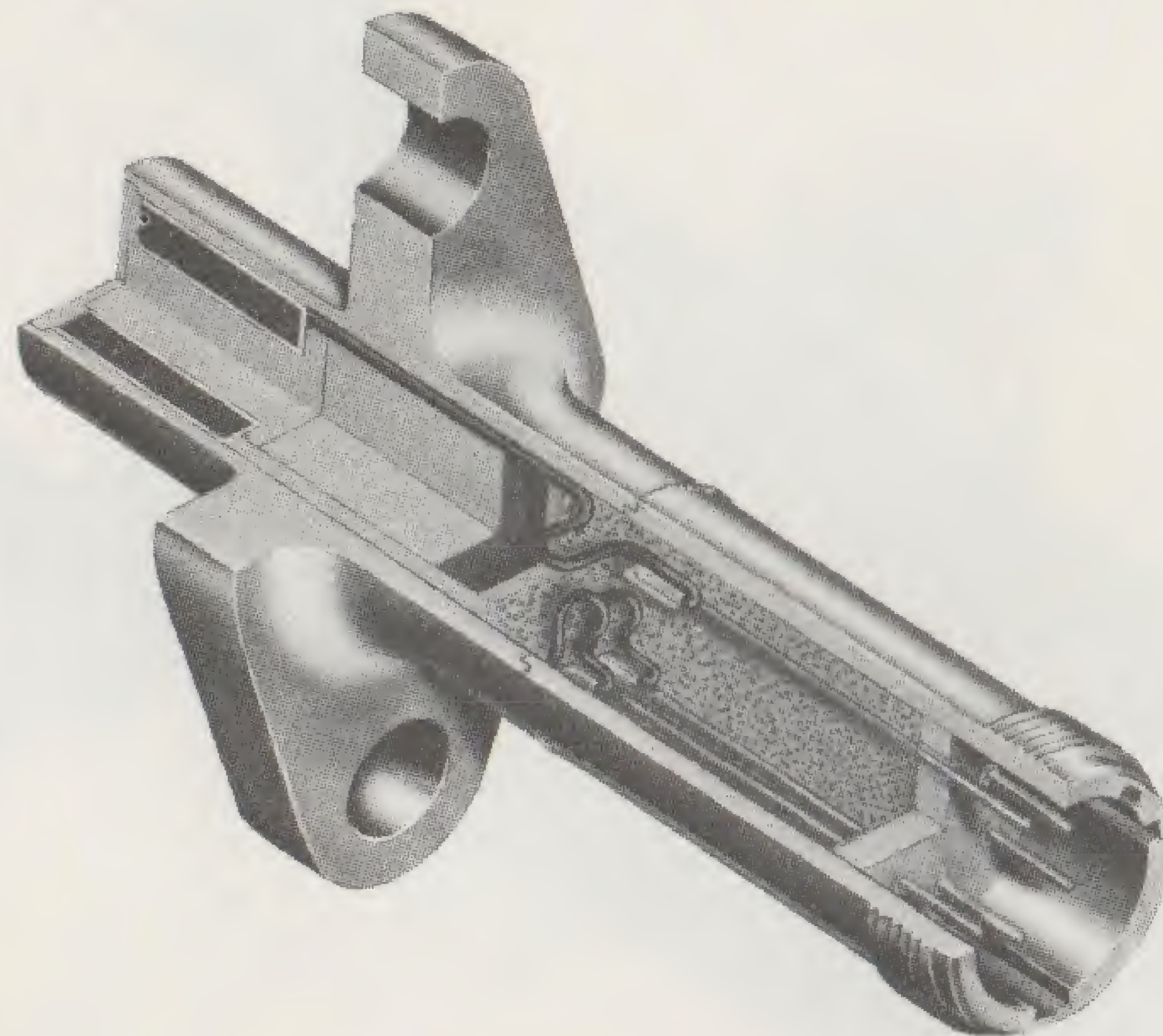


FIGURE 2-48. SSME FUEL FLOWMETER



2-70

FIGURE 2-49. FLOW SENSOR

FIGURE 2-50. FLOWMETER

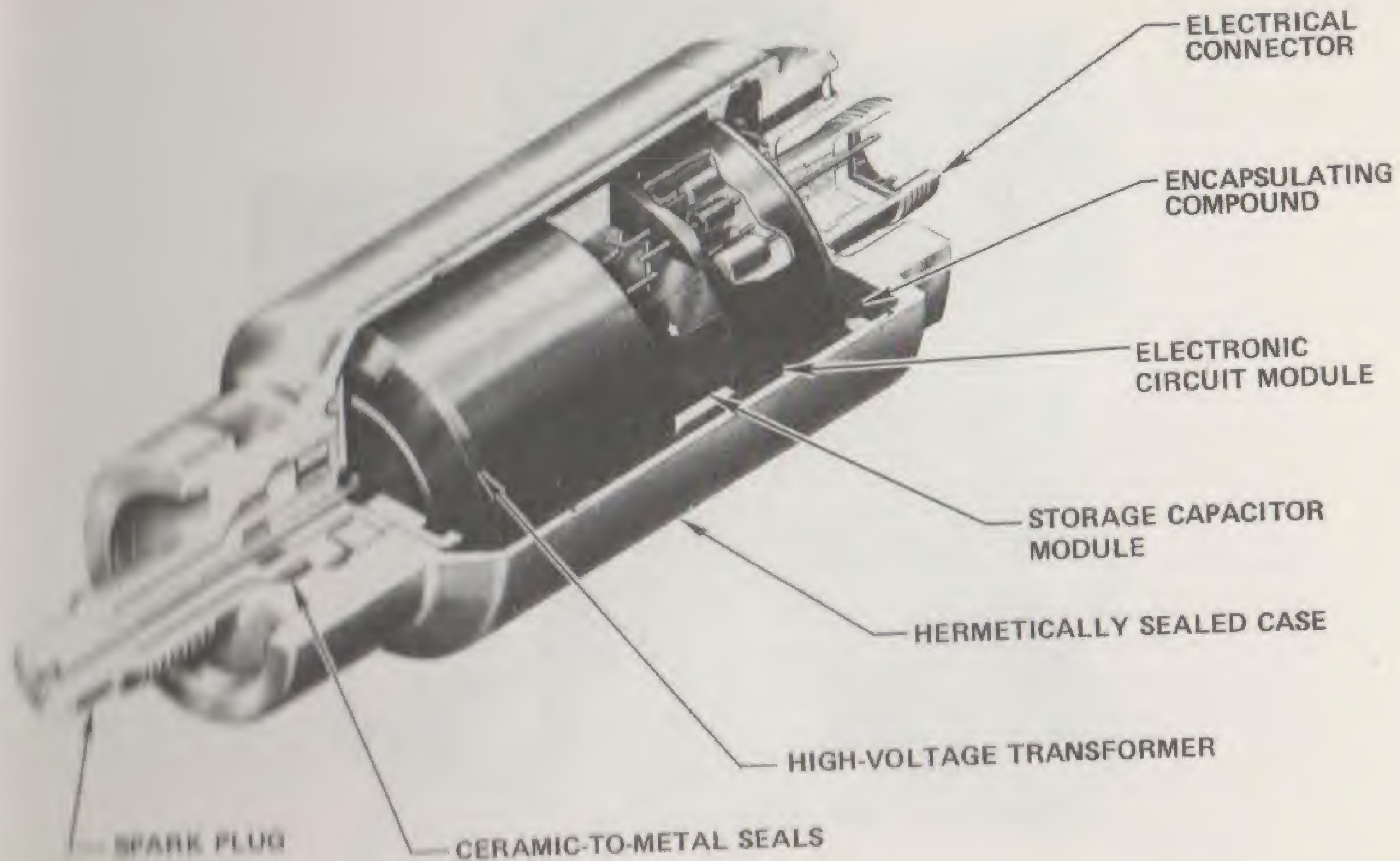


FIGURE 2-50. SPARK IGNITER

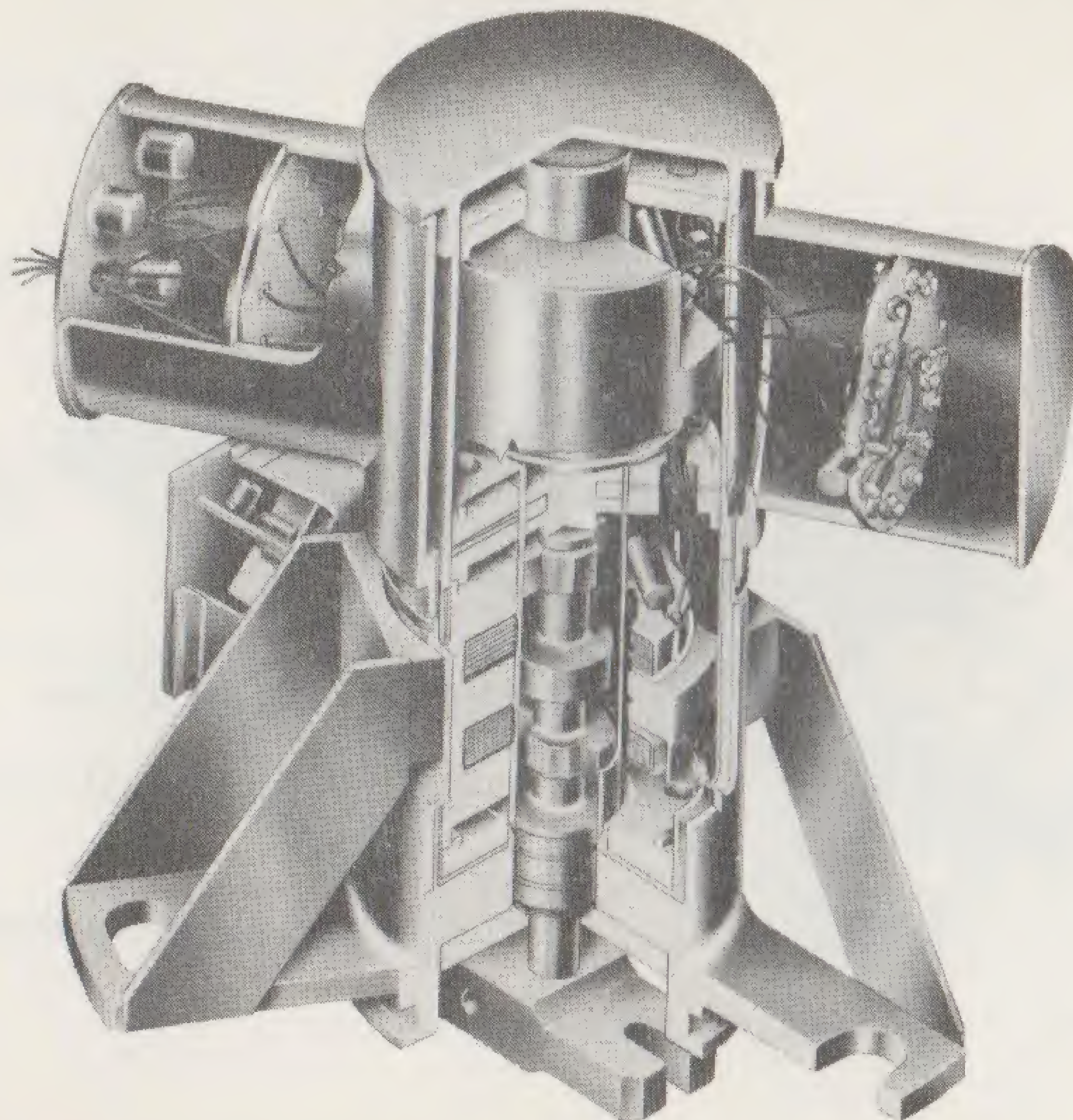


FIGURE 2-51. ROTARY VARIABLE DIFFERENTIAL TRANSFORMER (RVDT)

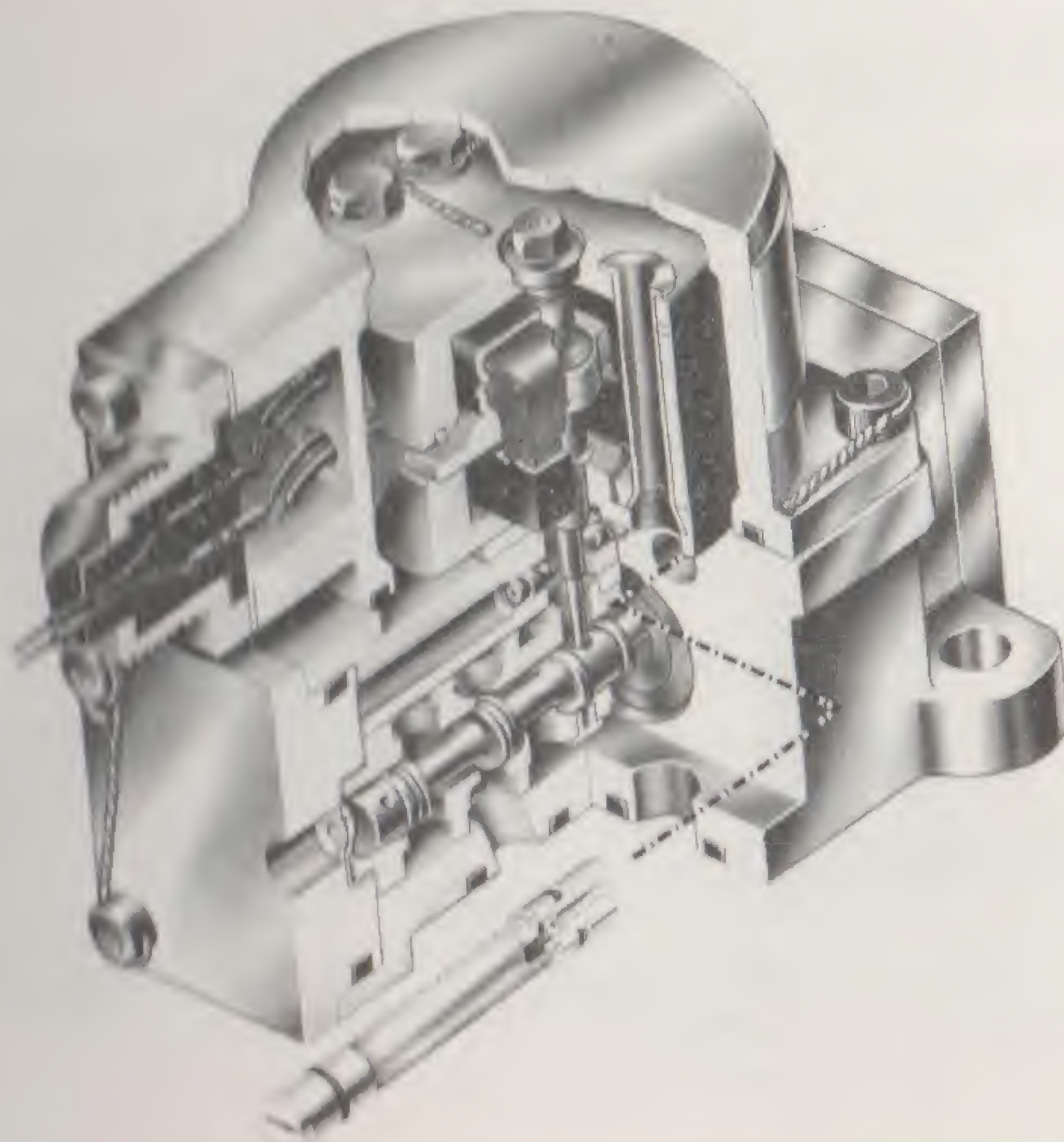


FIGURE 2-52. SERVOVALVE ASSEMBLY

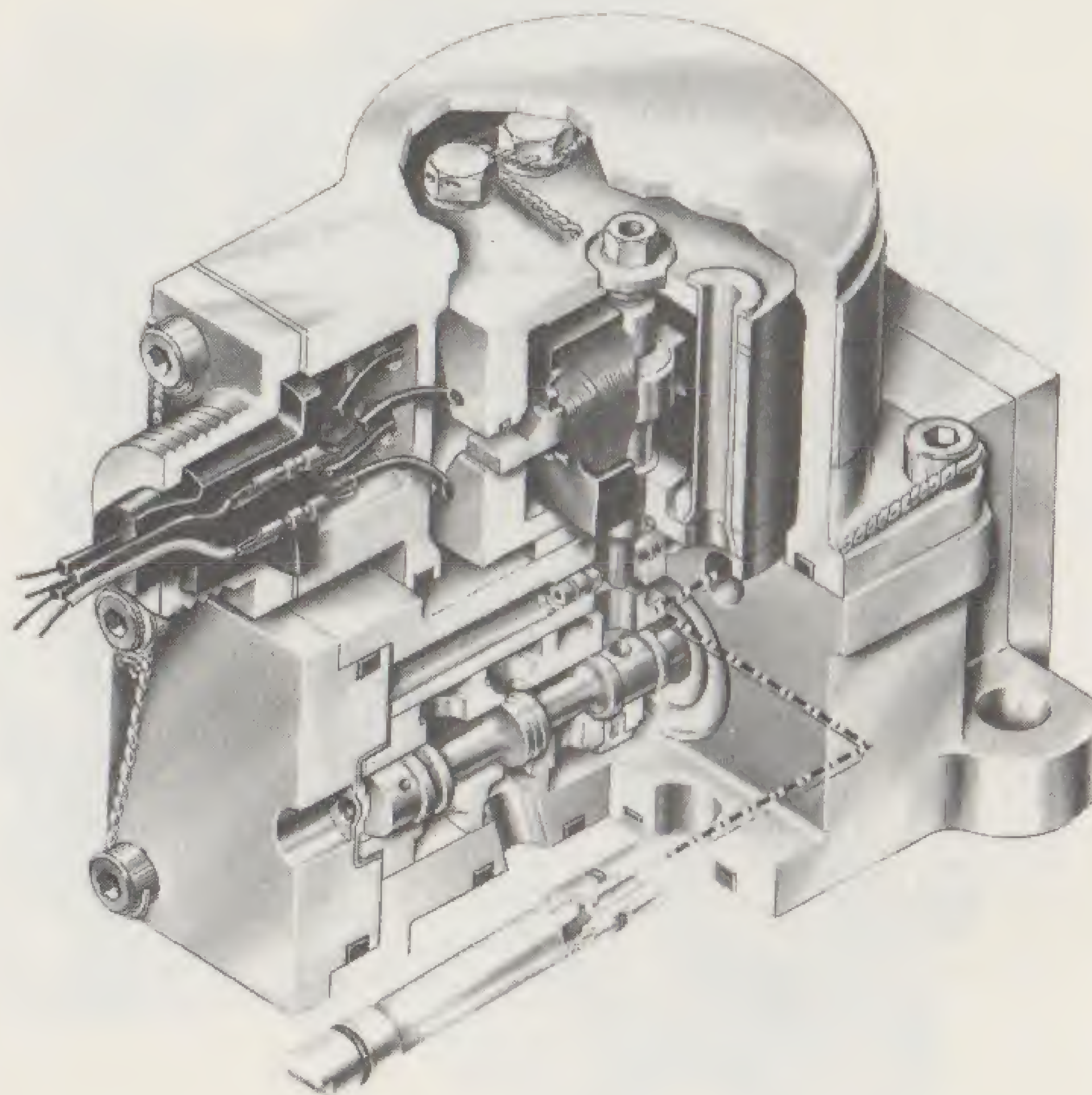


FIGURE 2-53. SERVOSWITCH ASSEMBLY

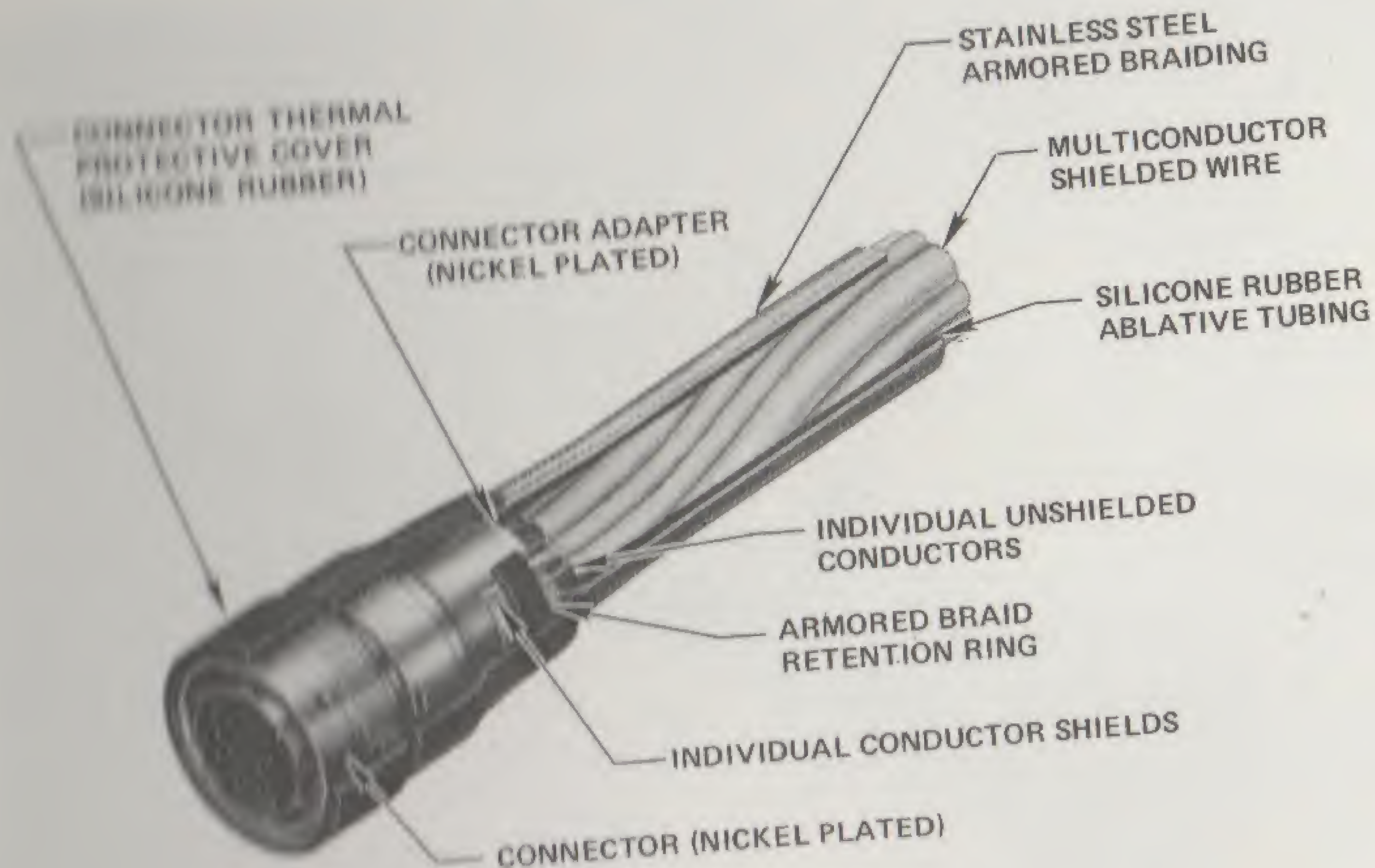


FIGURE 2-54. FLEXIBLE ARMORED HARNESS

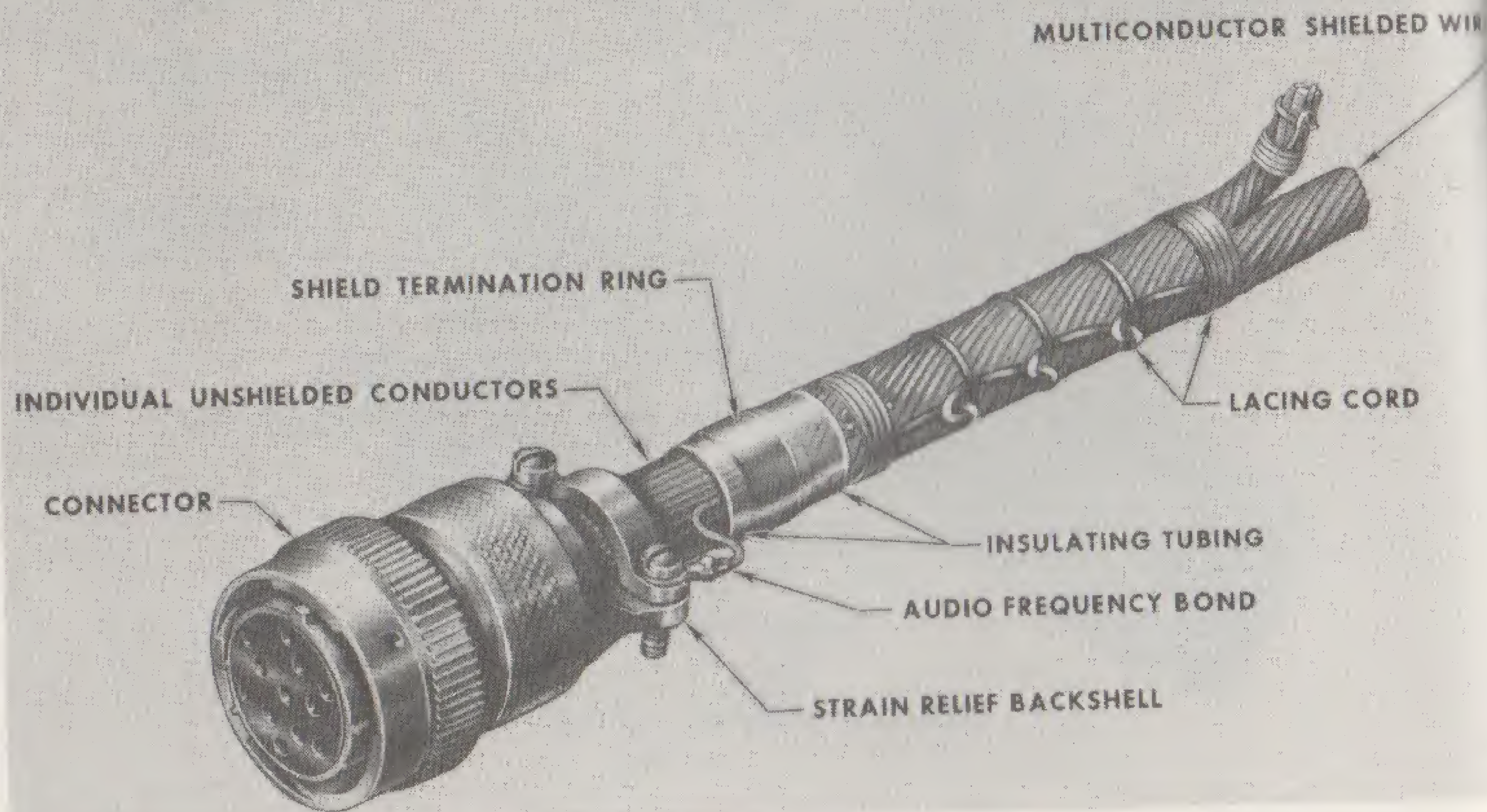


FIGURE 2-55. CONVENTIONAL HARNESS

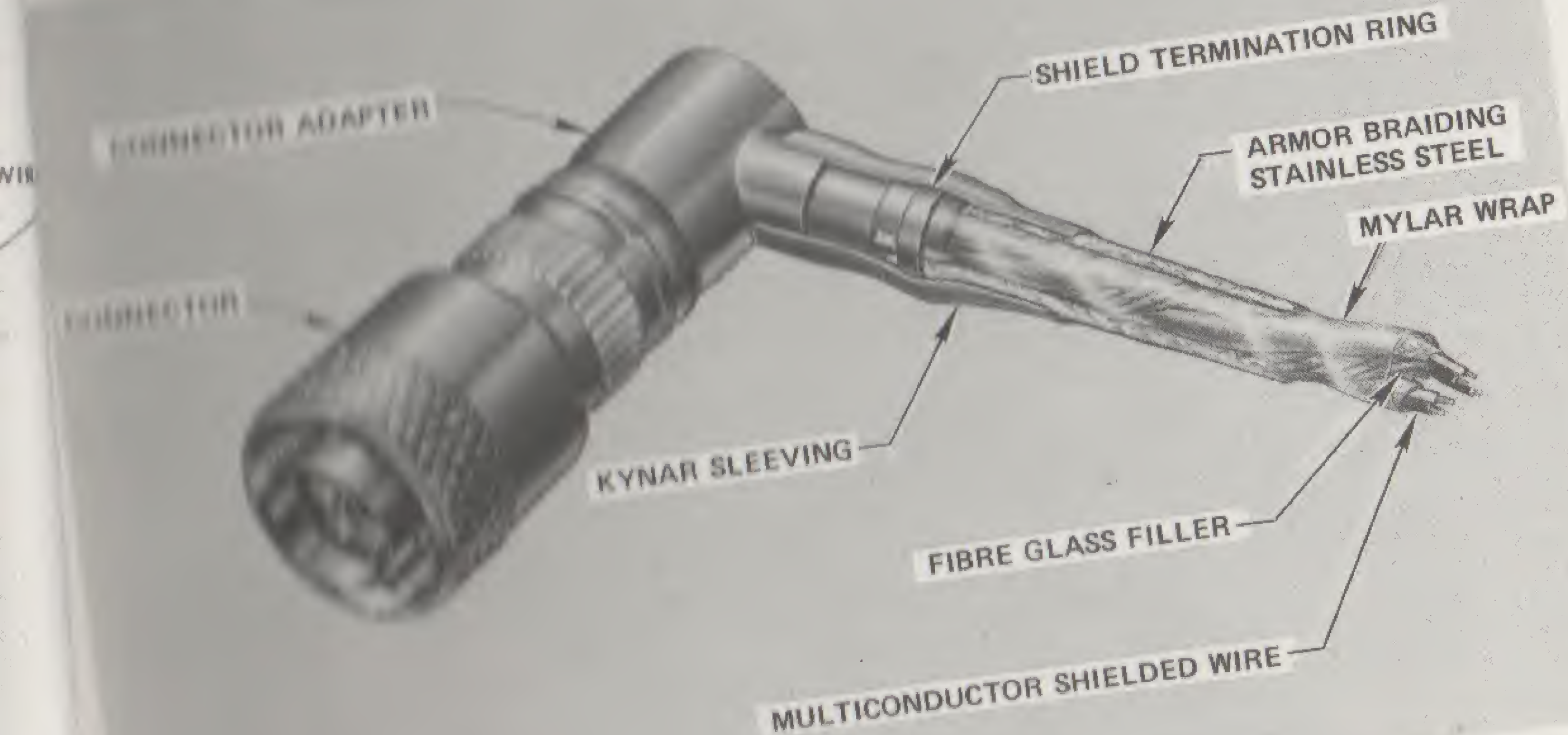
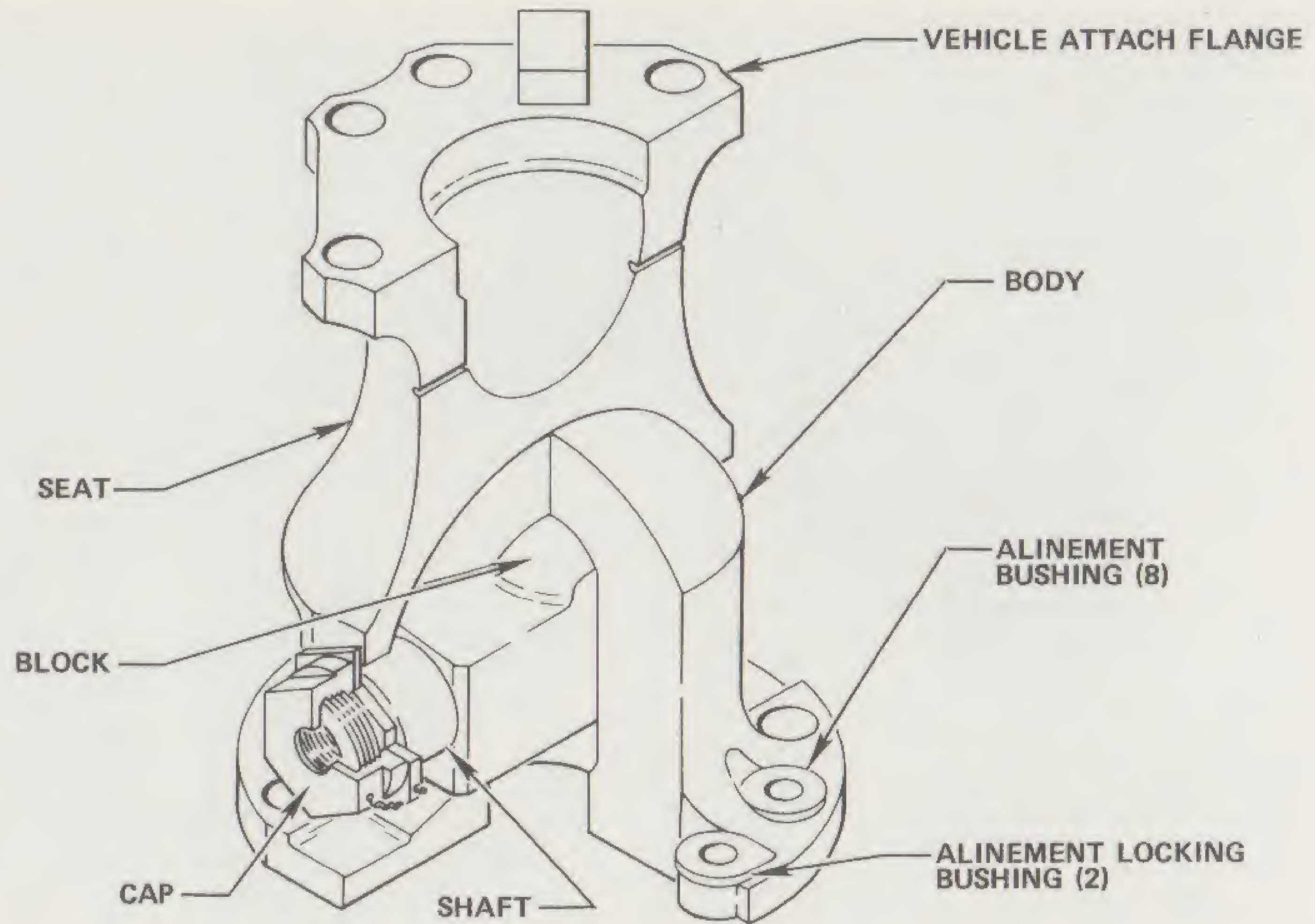


FIGURE 2-56. LIGHTNING BRAIDED HARNESS



- ANGULATION CAPABILITY ± 12.5 DEGREES ABOUT EACH OF TWO AXES. THIS INCLUDES:
 - 0.5 DEGREE FOR SNUBBING
 - 0.5 DEGREE FOR ANGULAR ALIGNMENT
 - 6 MINUTES OVER-TRAVEL VECTOR ADJUSTMENT
 - 0.7 DEGREE FOR GIMBAL ATTACH POINT TOLERANCE
- ACCELERATION = 30 RAD/SEC^2 MAXIMUM
- ANGULAR VELOCITY - 20 DEGREES/SEC MAXIMUM
- LATERAL ADJUSTMENT - $\pm .25$ INCH MAXIMUM
- COEFFICIENT OF FRICTION - 0.01 TO 0.20 OVER TEMPERATURE RANGE OF 160 TO 610⁰R

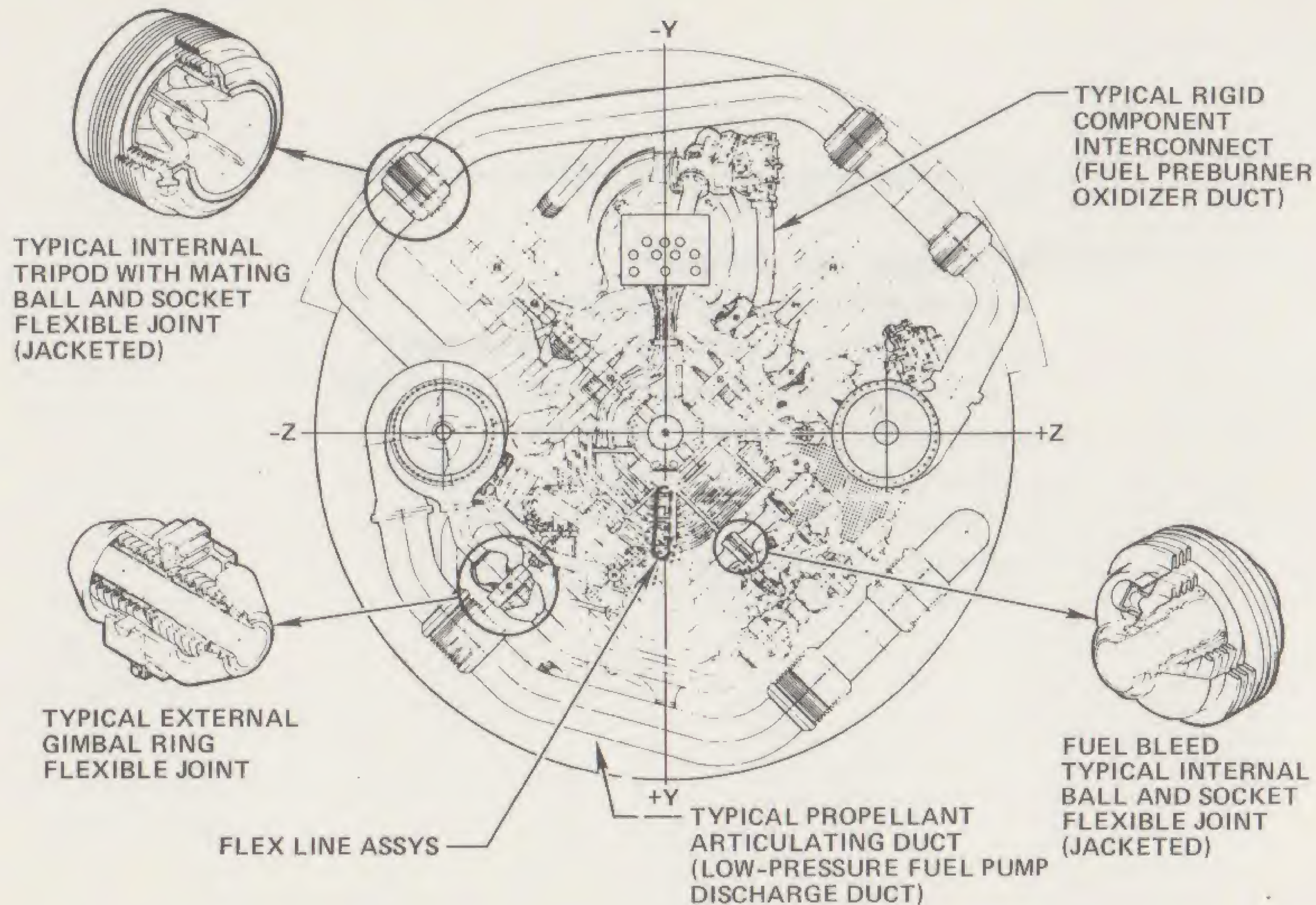
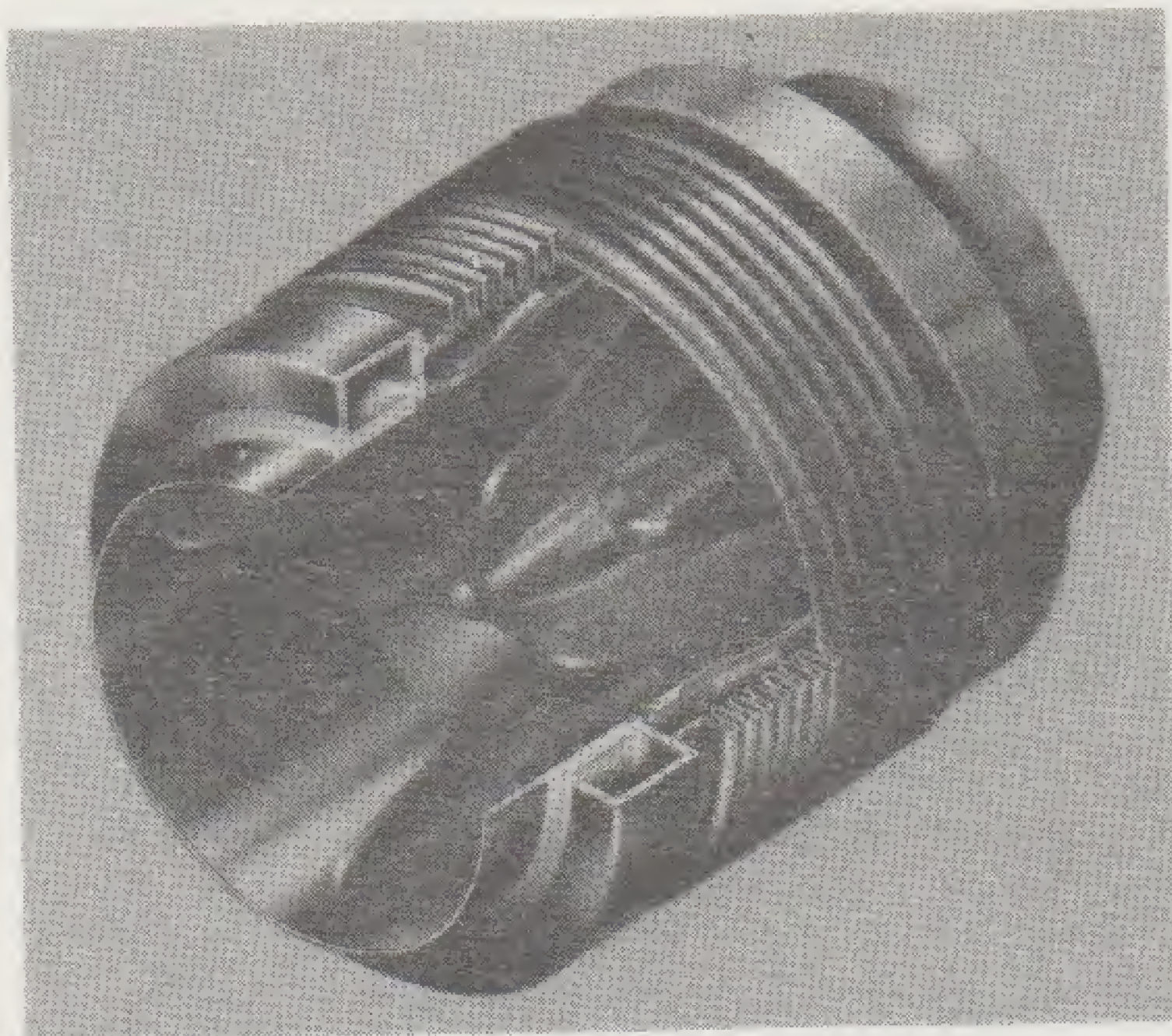


FIGURE 2-58. TYPICAL FLEX BELLOWS APPLICATIONS



OPERATING PRESSURE..... 300 TO 600 PSIA

TEMP..... -290F

I.D..... 6.3 INCH LINER

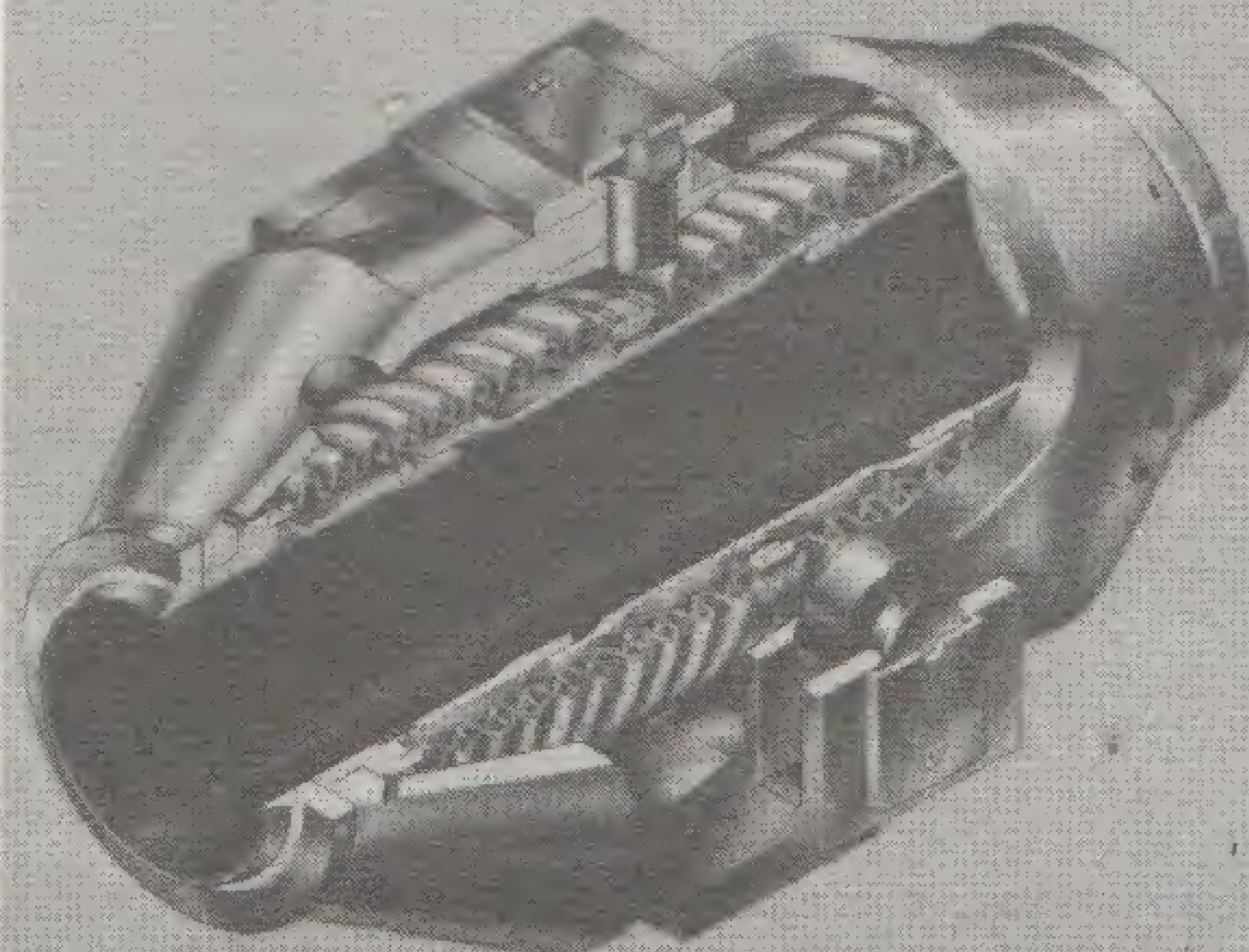
ANGULAR DISPLACEMENT..... $\pm 13^{\circ}$

LIFE..... 200 OPERATIONAL
1400 NON-OPERATIONAL
FULL DEFLECTION CYCLES

MATERIAL..... LPOP DISCH: INCONEL 718
LPFP DISCH: ARMCO 21-6-9

PICTURE IS TYPICAL OF..... LPOP DISCH

FIGURE 2-59. INTERNALLY TIED FLEX JOINTS



OPERATING PRESSURE 4000 TO 6000 PSIA

TEMP RANGE AMB. TO 670F

I.D. 75 TO 2.70 INCH LINER

ANGULAR DISPLACEMENT $\pm 13.25^\circ$

LIFE 200 OPERATIONAL
1400 NON-OPERATIONAL
FULL DEFLECTION CYCLES

MATERIAL INCONEL 718
INCONEL 903
TITANIUM

TYPICAL OF

LPOP TURBINE DRIVE

OXID TANK PRESSURANT

LPFP TURBINE DRIVE

LPFP TURBINE DISCH.

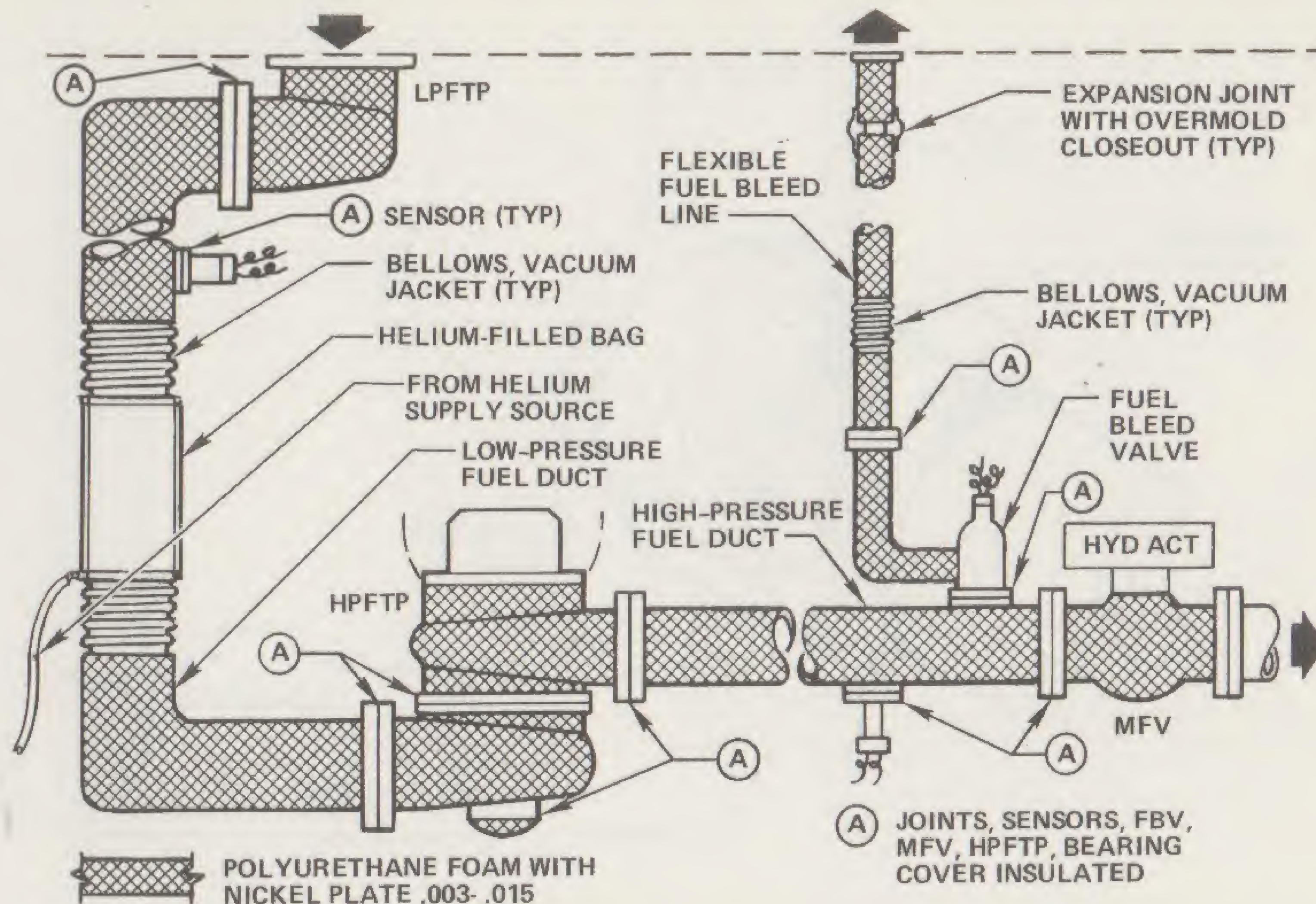


FIGURE 2-61. FUEL SYSTEM INSULATION

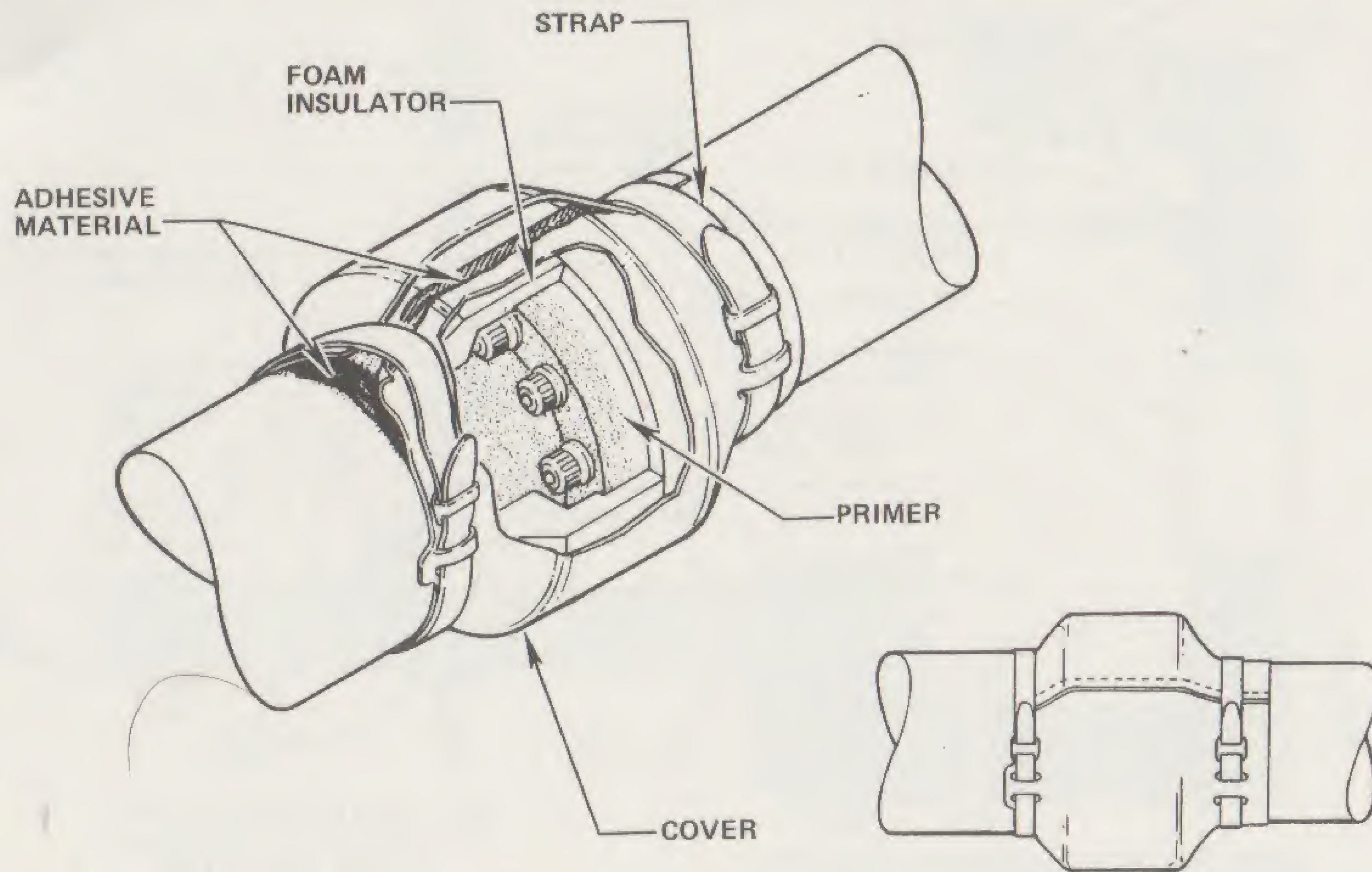


FIGURE 2-62. TYPICAL JOINT INSULATION

SECTION III

GROUND TURNAROUND OPERATIONS AND MAINTENANCE

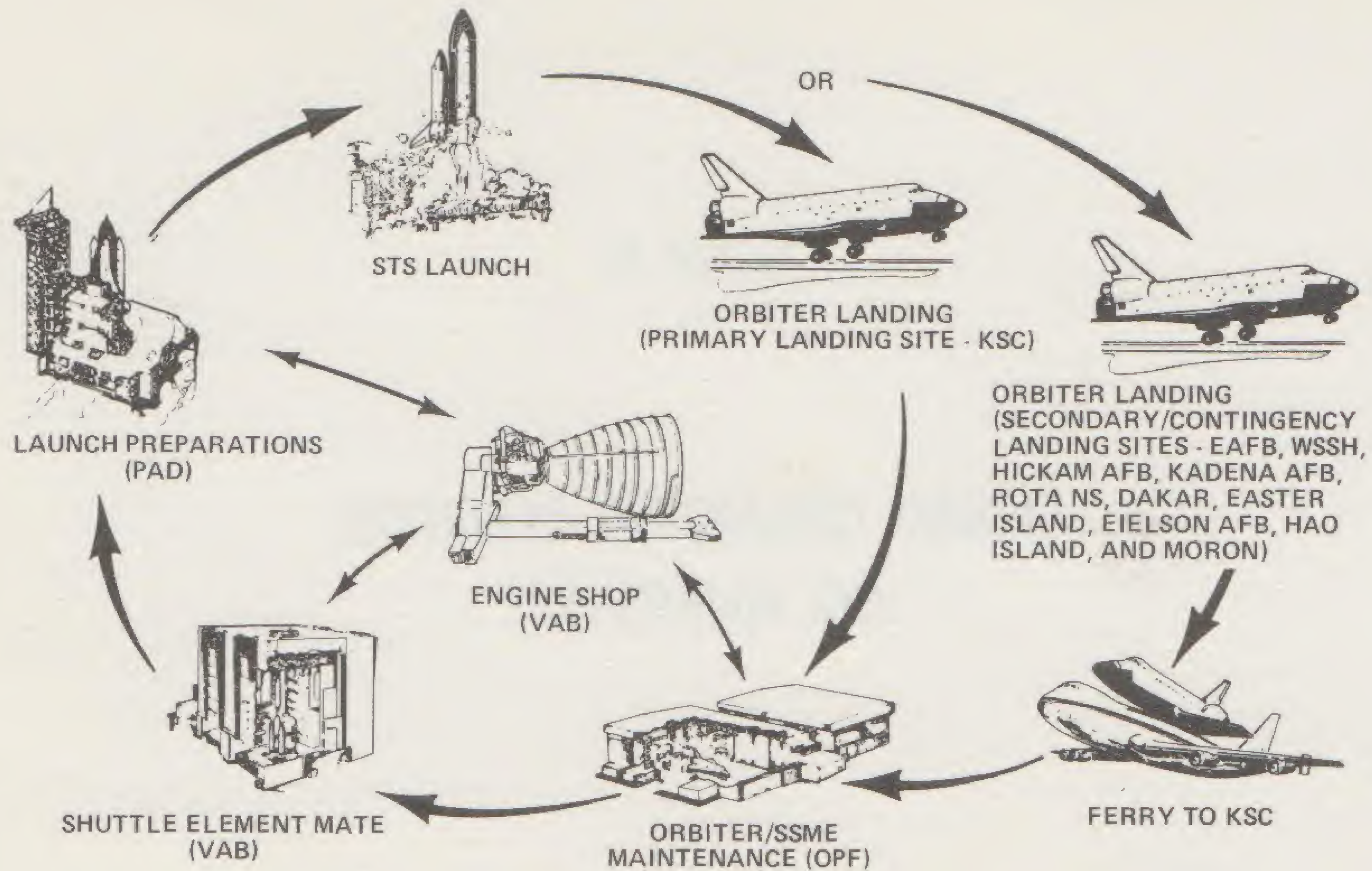
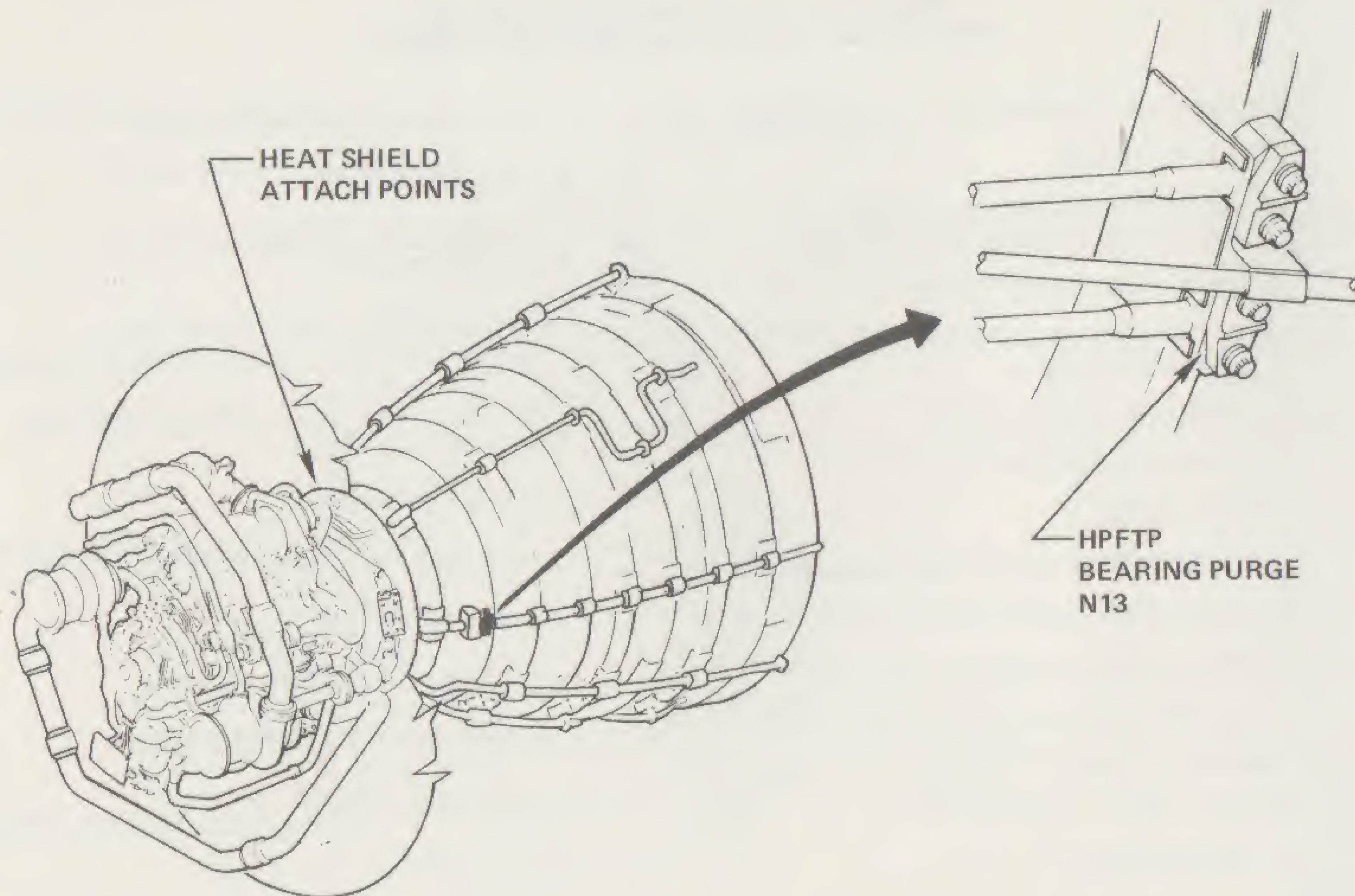


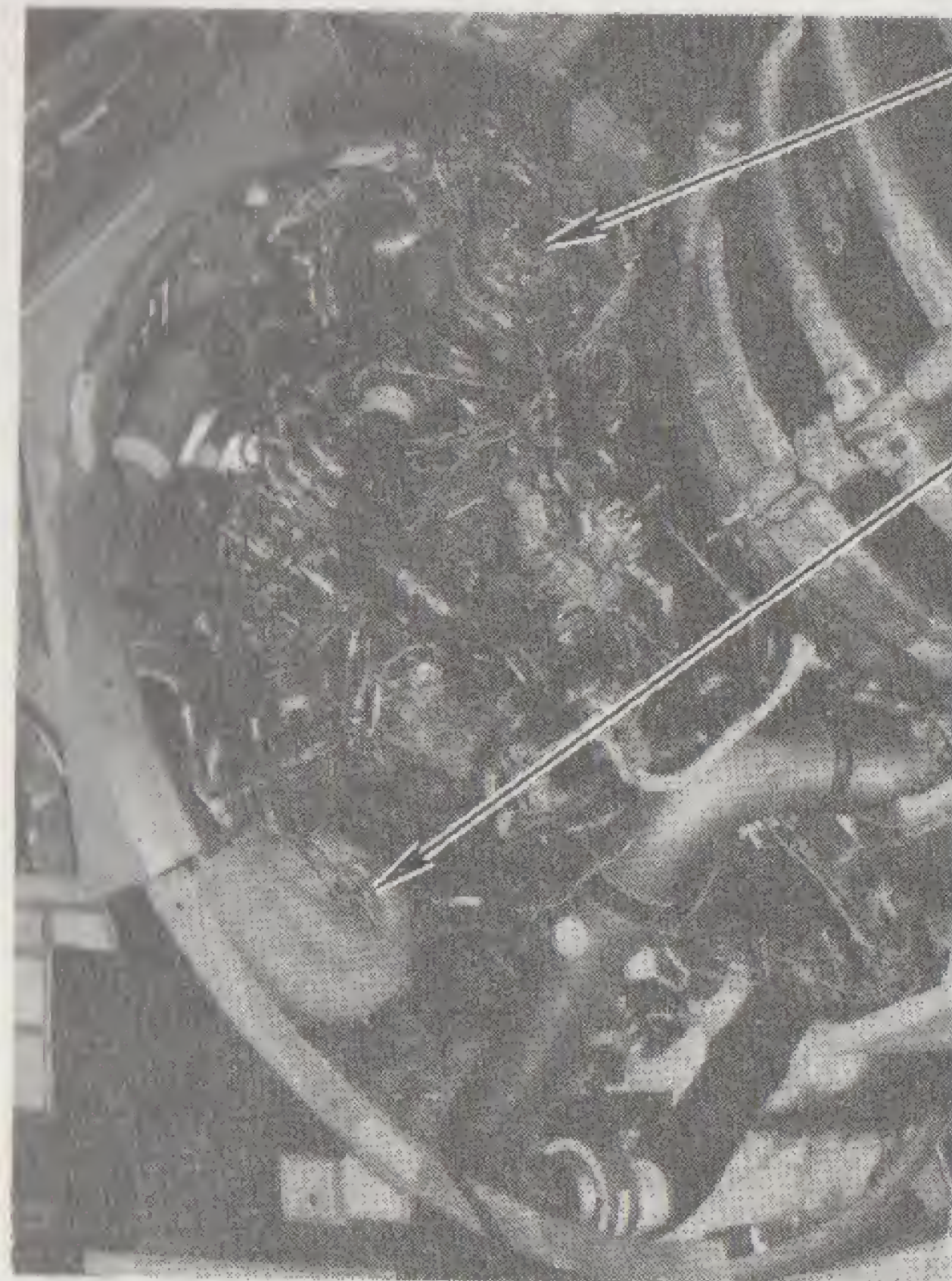
FIGURE 3-1. KSC STS/SSME TURNAROUND FLOW

SPACE SHUTTLE MAIN ENGINE GROUND TURNAROUND OPERATIONS AND MAINTENANCE

- SCHEDULED TURNAROUND MAINTENANCE
 - ROUTINE TASKS
 - HIGH-PRESSURE FUEL TURBO-PUMP TURBINE BEARING DRYING
 - EXTERNAL INSPECTIONS
 - TURBOPUMP TORQUE/SHAFT POSITION CHECKS
 - INTERNAL INSPECTIONS
 - ENGINE SERVICING
 - LEAK TESTS
 - AUTOMATIC/ELECTRICAL CHECKOUTS
 - PRELAUNCH CONFIDENCE CHECK
 - PRELAUNCH CLOSEOUT INSPECTION
 - LAUNCH SITE LANDING OPERATIONS
 - PERIODIC TASKS
 - LEAK TESTS
 - INSPECTIONS
- UNSCHEDULED MAINTENANCE
 - AS REQUIRED
 - REMOTE SITE LANDING REQUIREMENTS
 - SCHEDULED OPERATIONS AND MAINTENANCE
 - ENVIRONMENTAL PROTECTION SET INSTALLATION
 - HPFTP DRYING
 - FERRY FLIGHT SET INSTALLATION
 - LEAK CHECKS
 - TVC LOCK INSTALLATION
 - UNSCHEDULED MAINTENANCE
 - AS REQUIRED

FIGURE 3-2. SSME GROUND TURNAROUND OPERATIONS AND MAINTENANCE





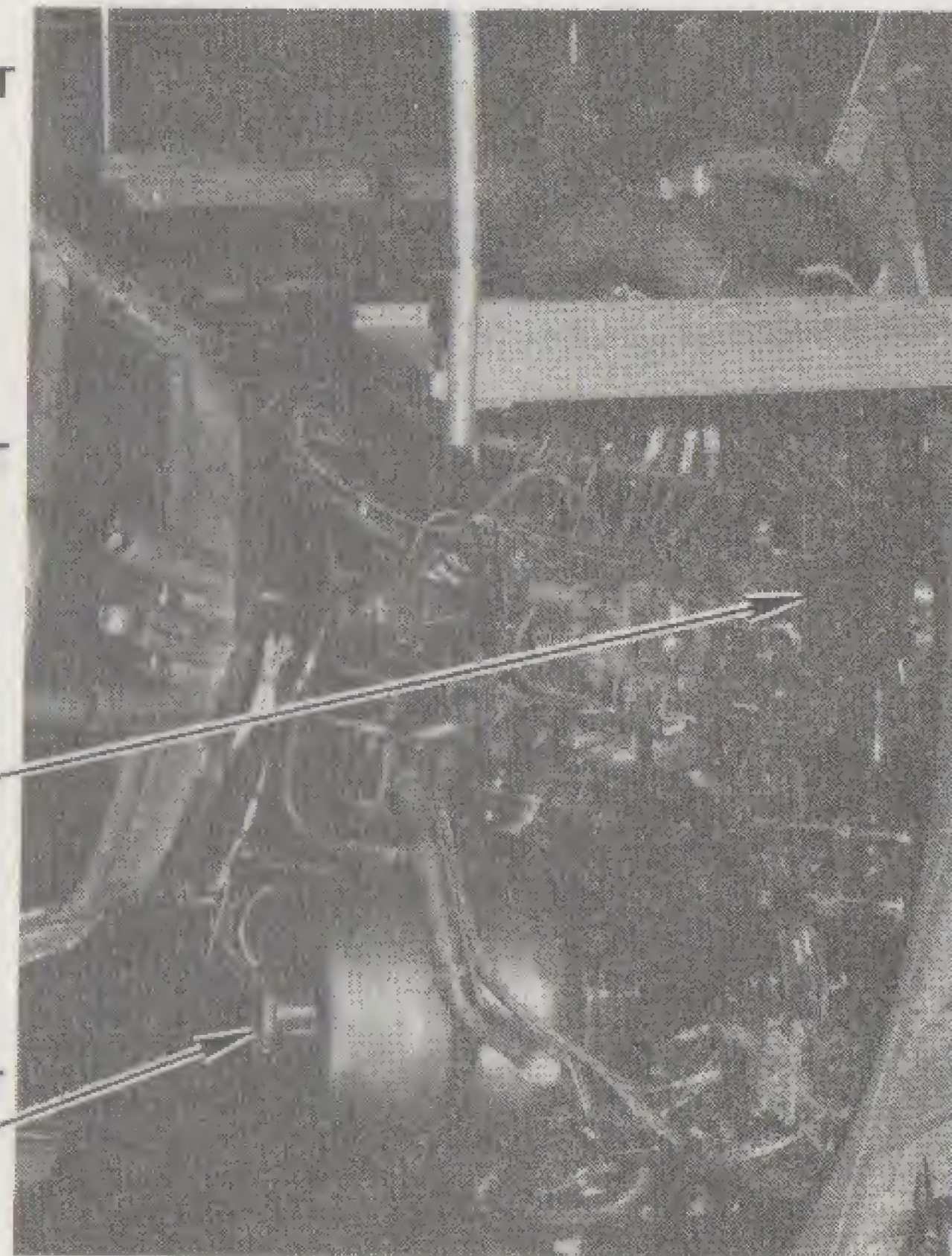
HPOTP
TORQUE/SHAFT
TRAVEL

LPOTP
TORQUE/SHAFT
TRAVEL

LPFTP
TORQUE

HPFTP
TORQUE/SHAFT
TRAVEL

ENGINE POSITION NO. 1



ENGINE POSITION NO. 1

FIGURE 3-4. SSME TURBOPUMP TORQUE/SHAFT TRAVEL

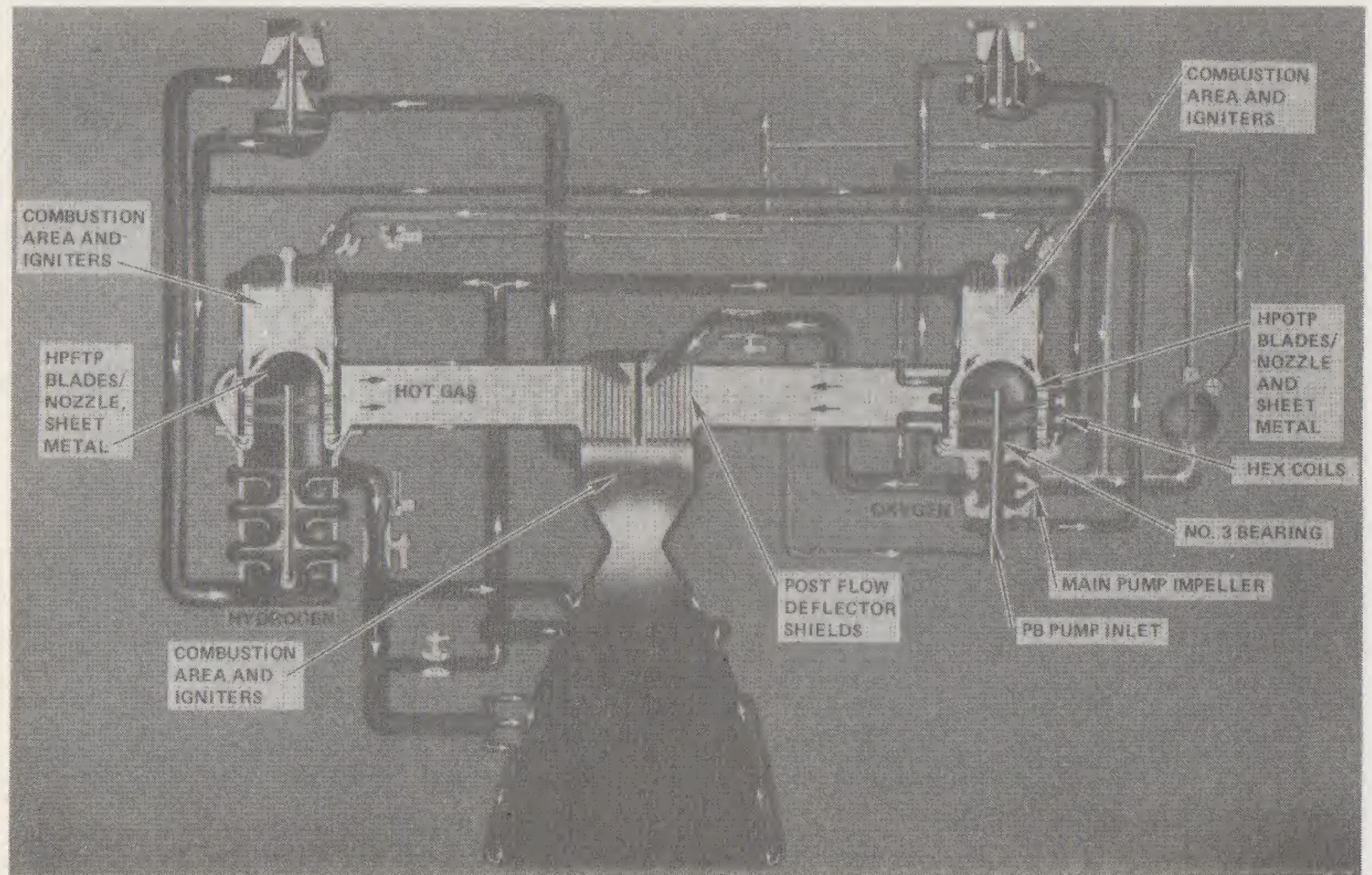


FIGURE 3-5. SSME INTERNAL INSPECTION AREAS

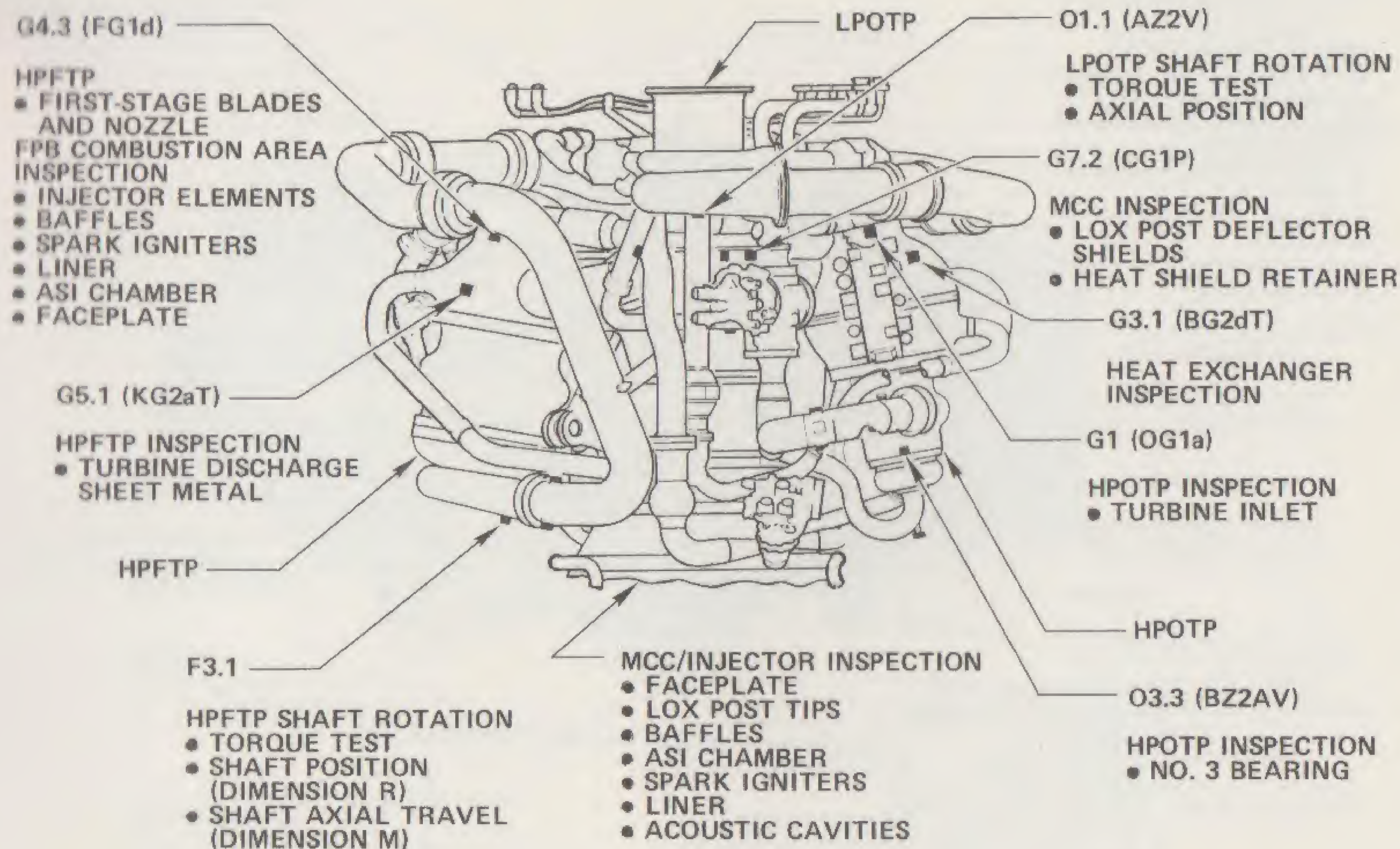


FIGURE 3-6. INTERNAL INSPECTION AND SHAFT ROTATION ACCESS - LPOTP SIDE OF ENGINE

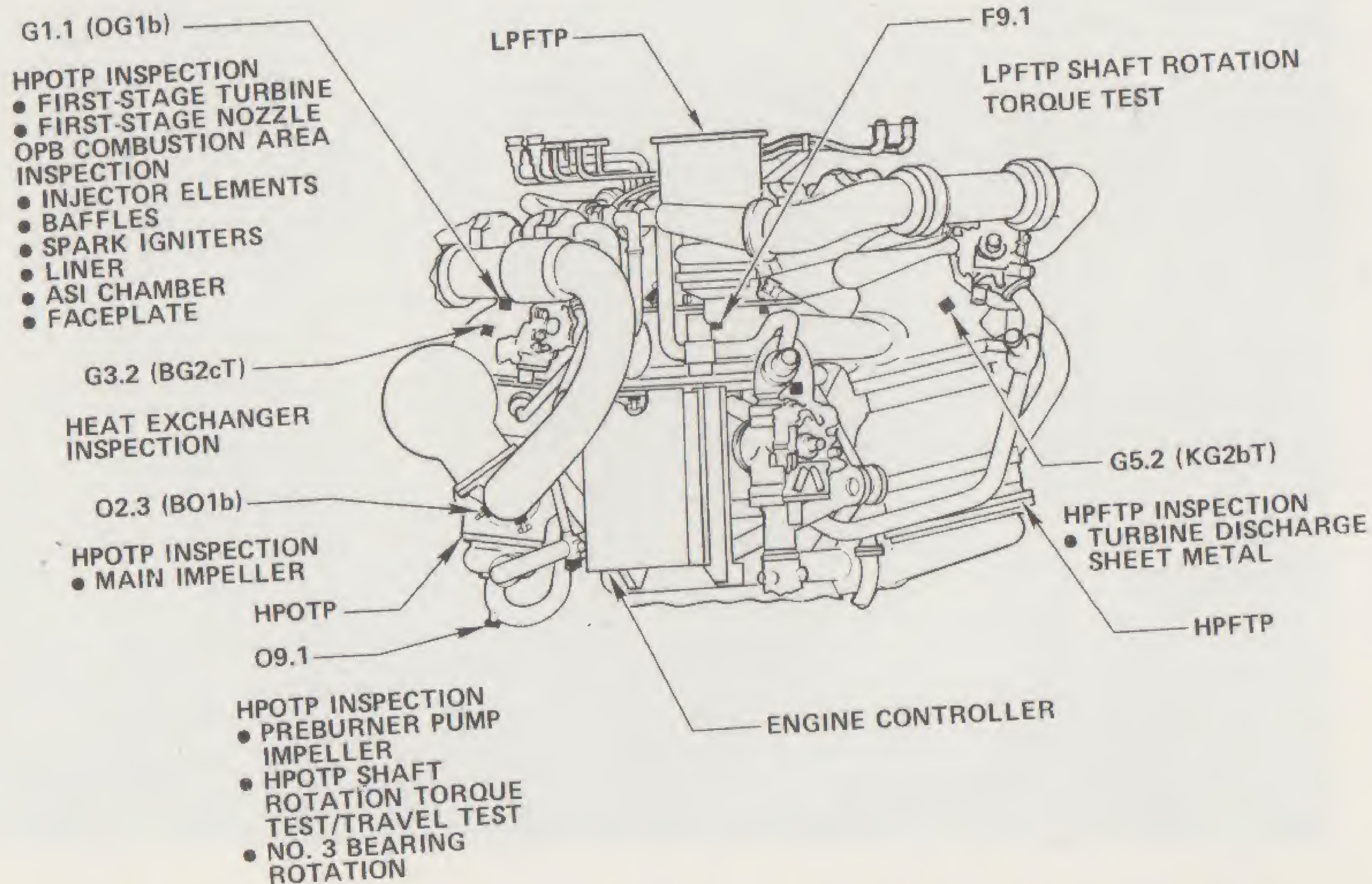


FIGURE 3-7. INTERNAL INSPECTION AND SHAFT ROTATION ACCESS - LPFTP SIDE OF ENGINE

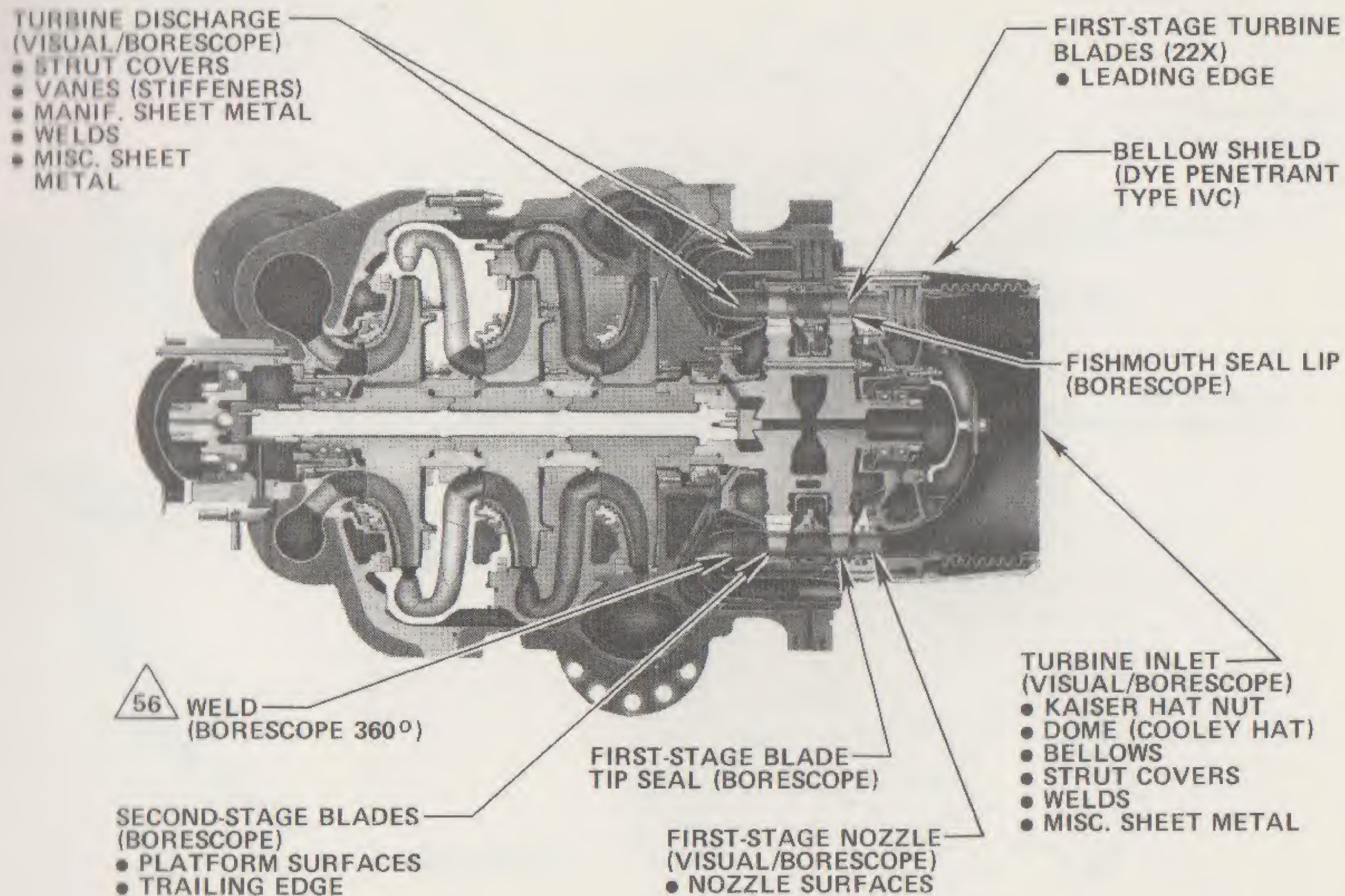


FIGURE 3-8. HPFTP TURBINE INSPECTION REQUIREMENTS

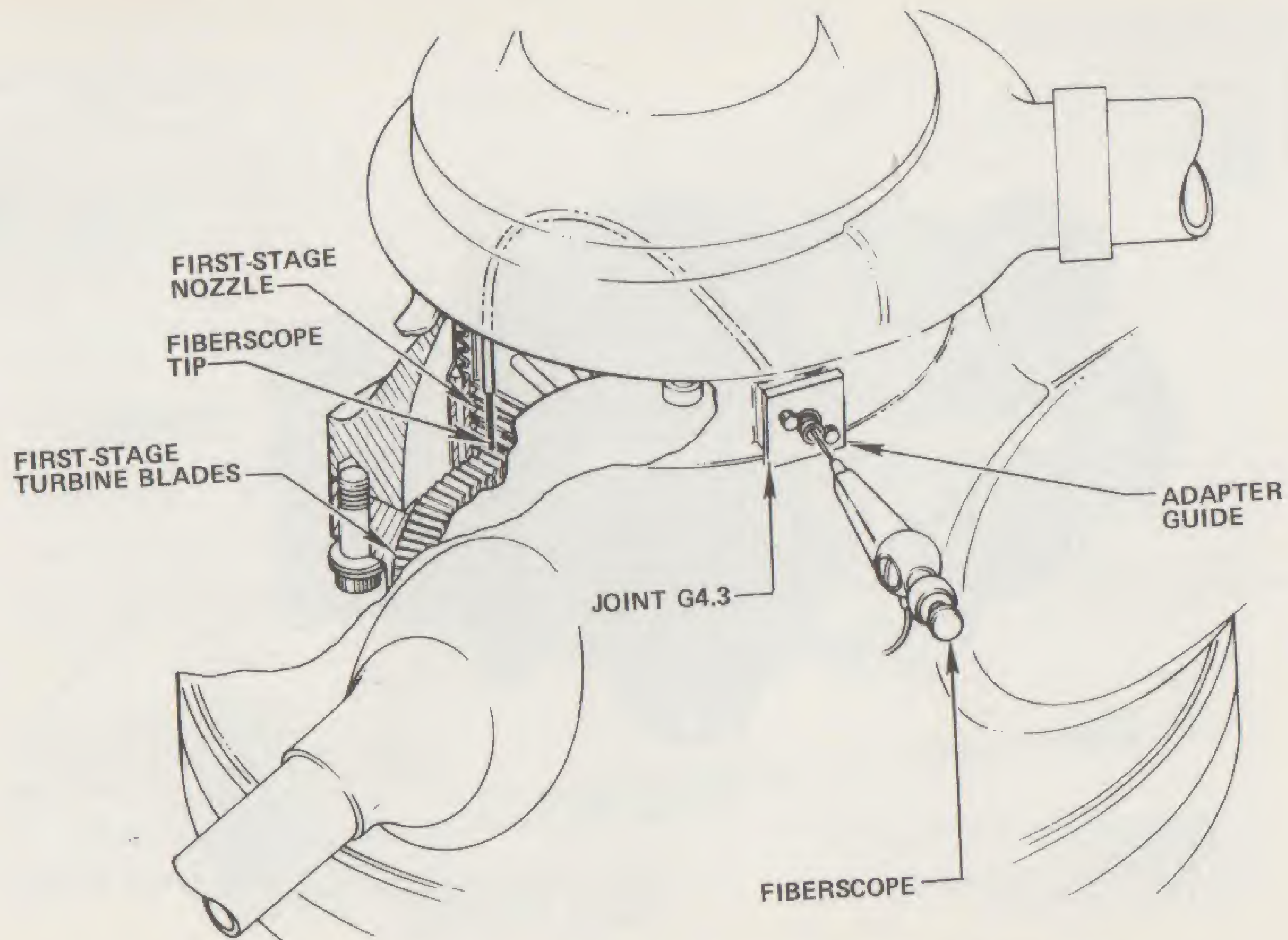


FIGURE 3-9. HPFTP FIRST-STAGE TURBINE BLADES/NOZZLE INSPECTION

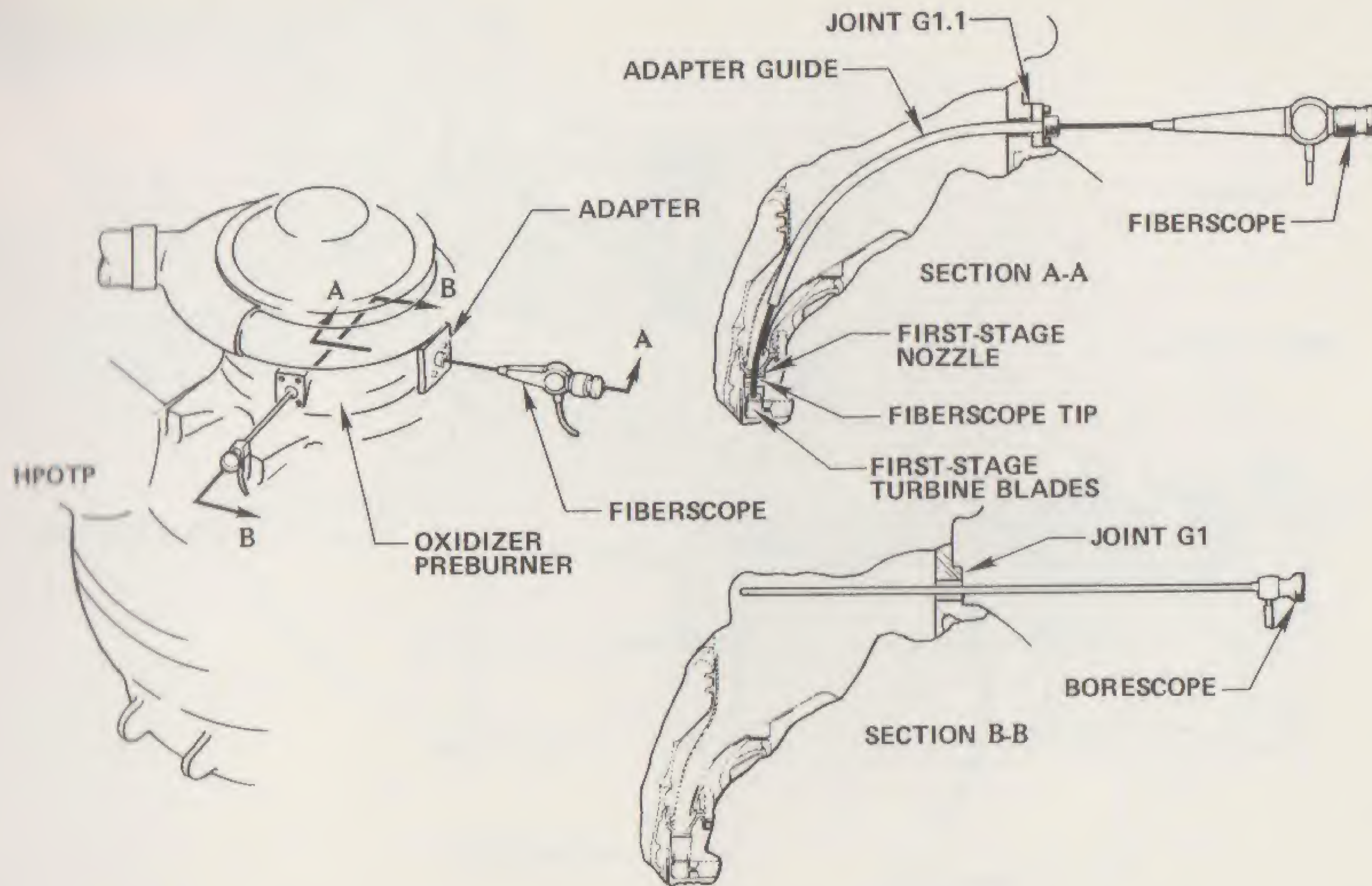


FIGURE 3-10. HPOTP FIRST-STAGE TURBINE BLADES/NOZZLE INSPECTION

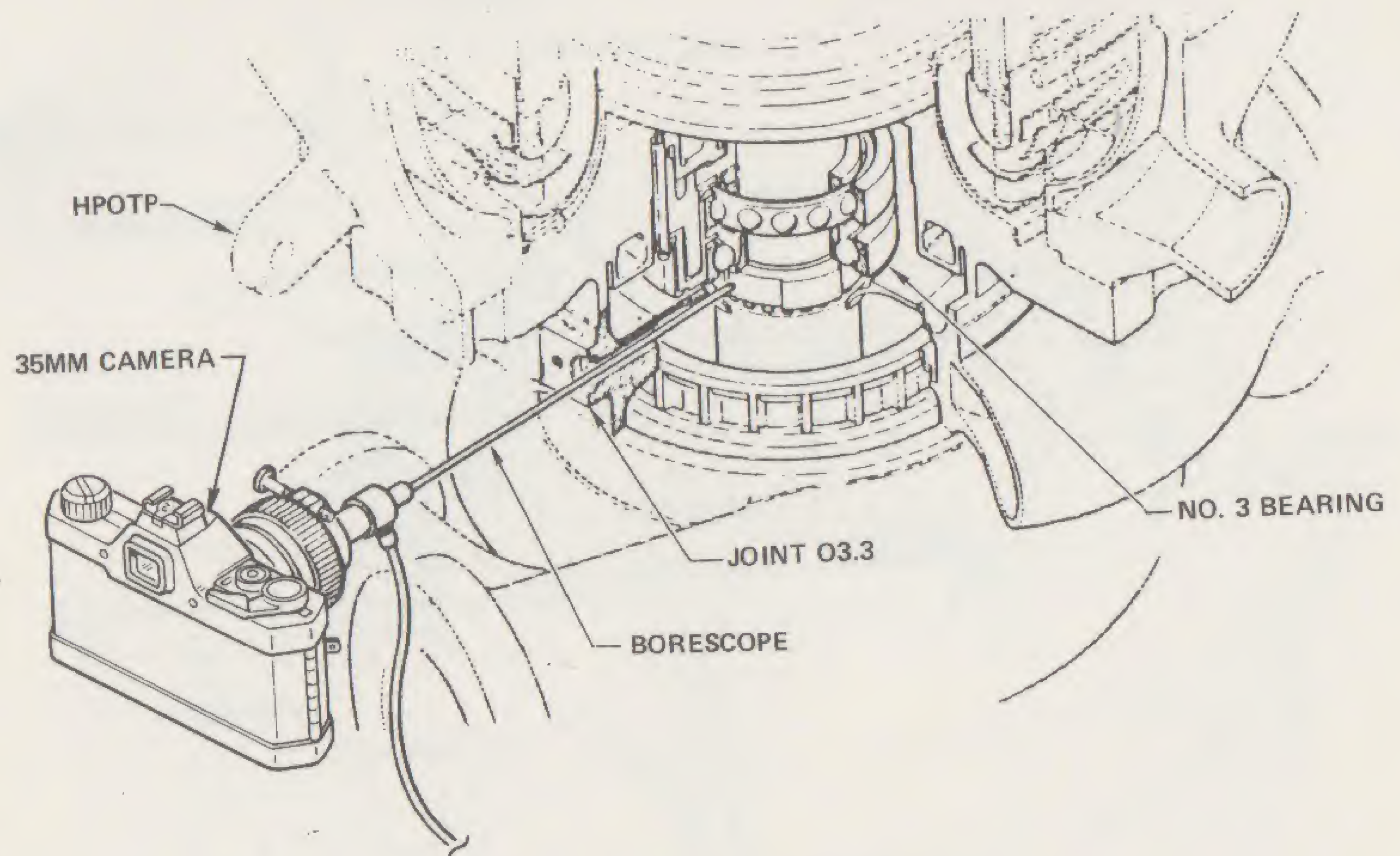


FIGURE 3-11. HPOTP NO. 3 BEARING INSPECTION

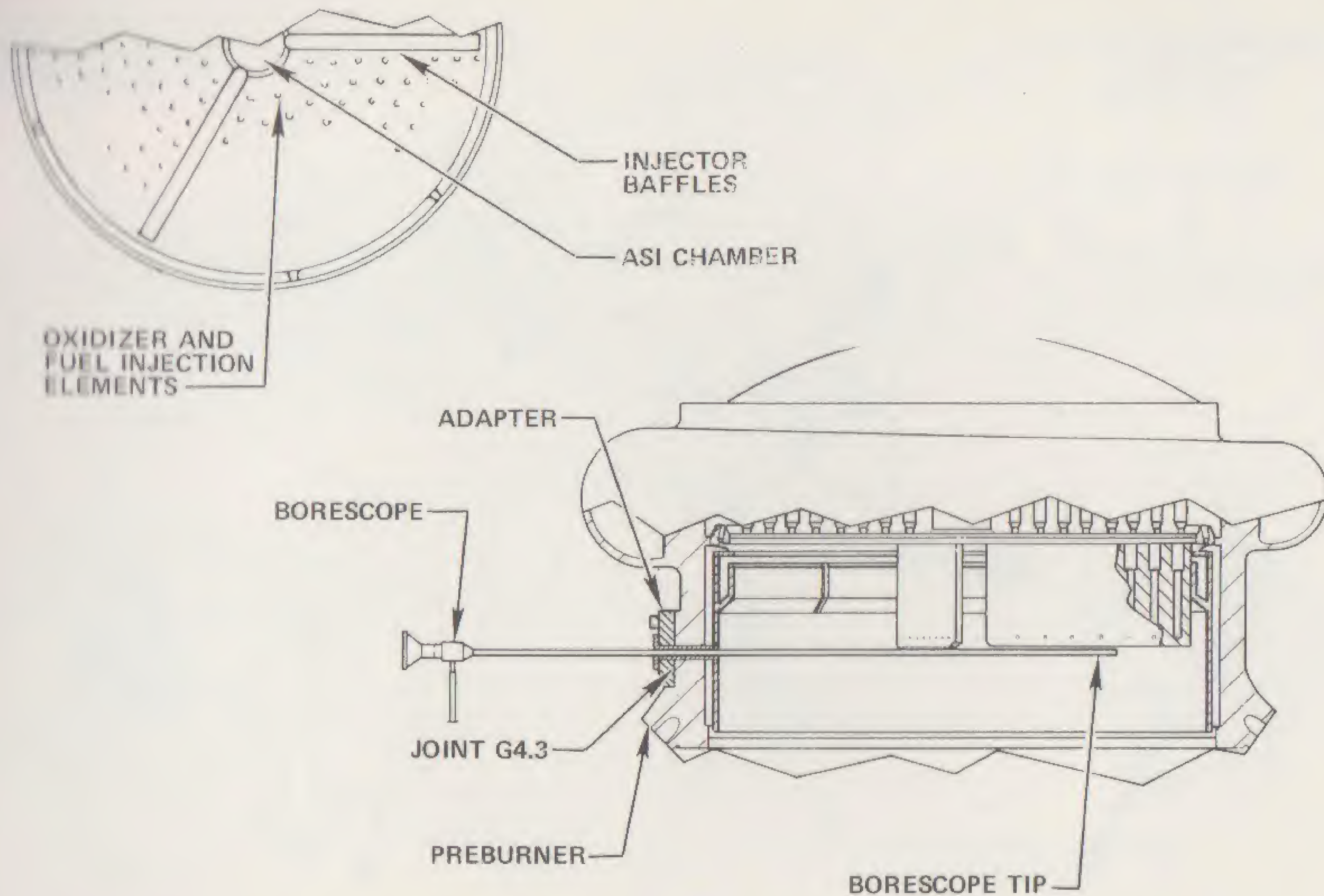


FIGURE 3-12. PREBURNER COMBUSTION AREA INSPECTION

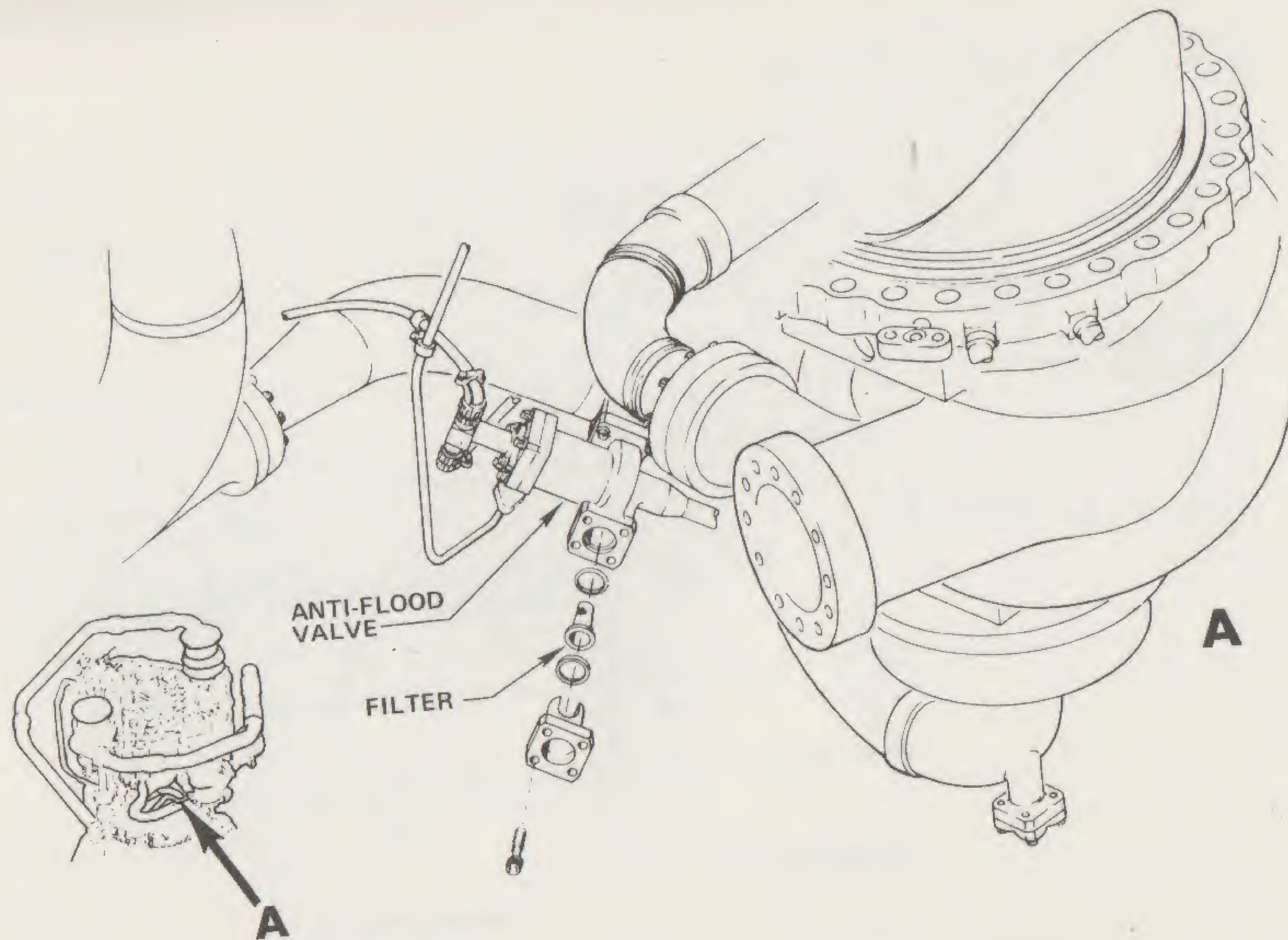


FIGURE 3-13. ANTI-FLOOD VALVE (AFV) FILTER REPLACEMENT

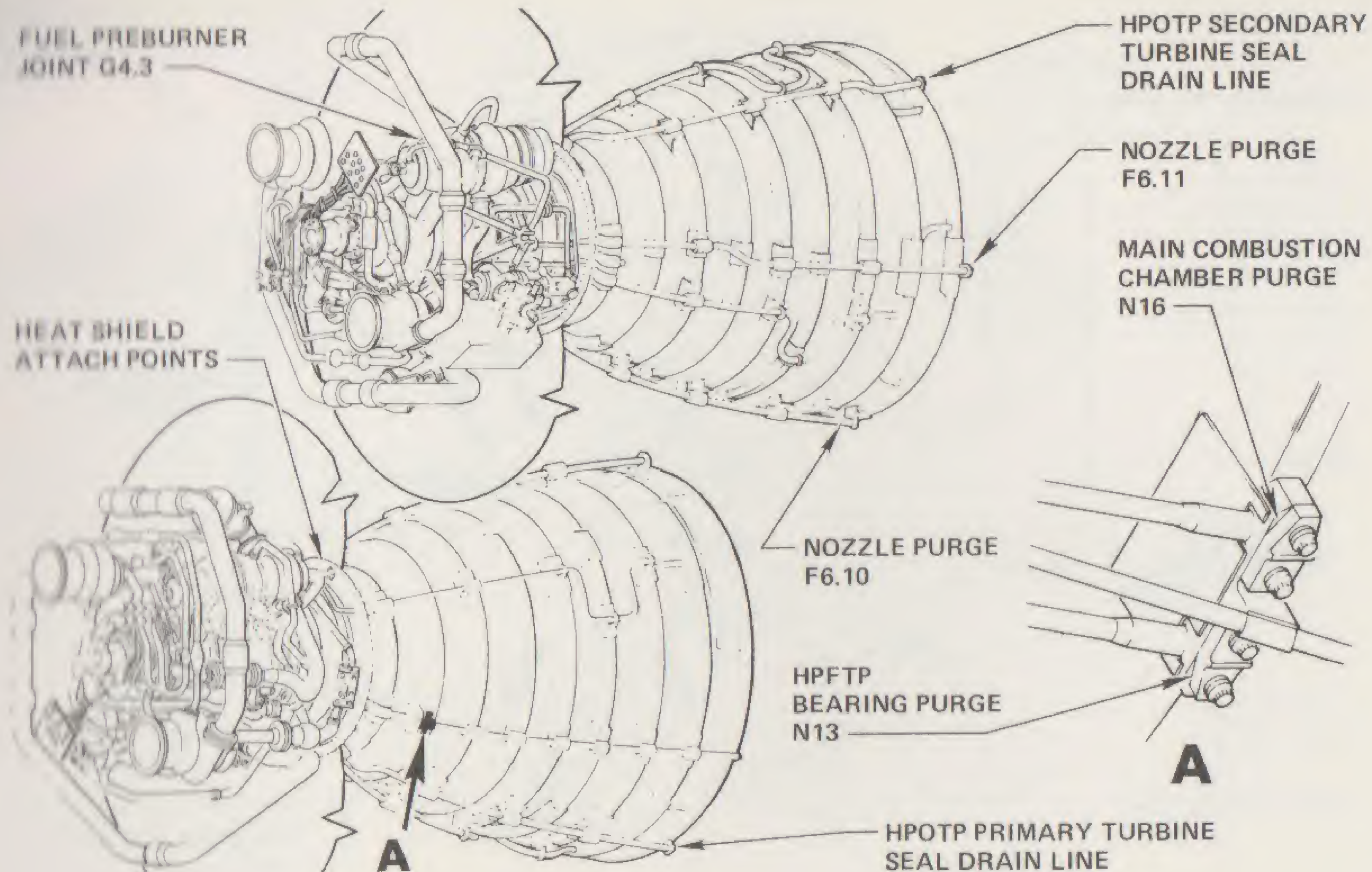


FIGURE 3-14. ENGINE DRYING INTERFACES

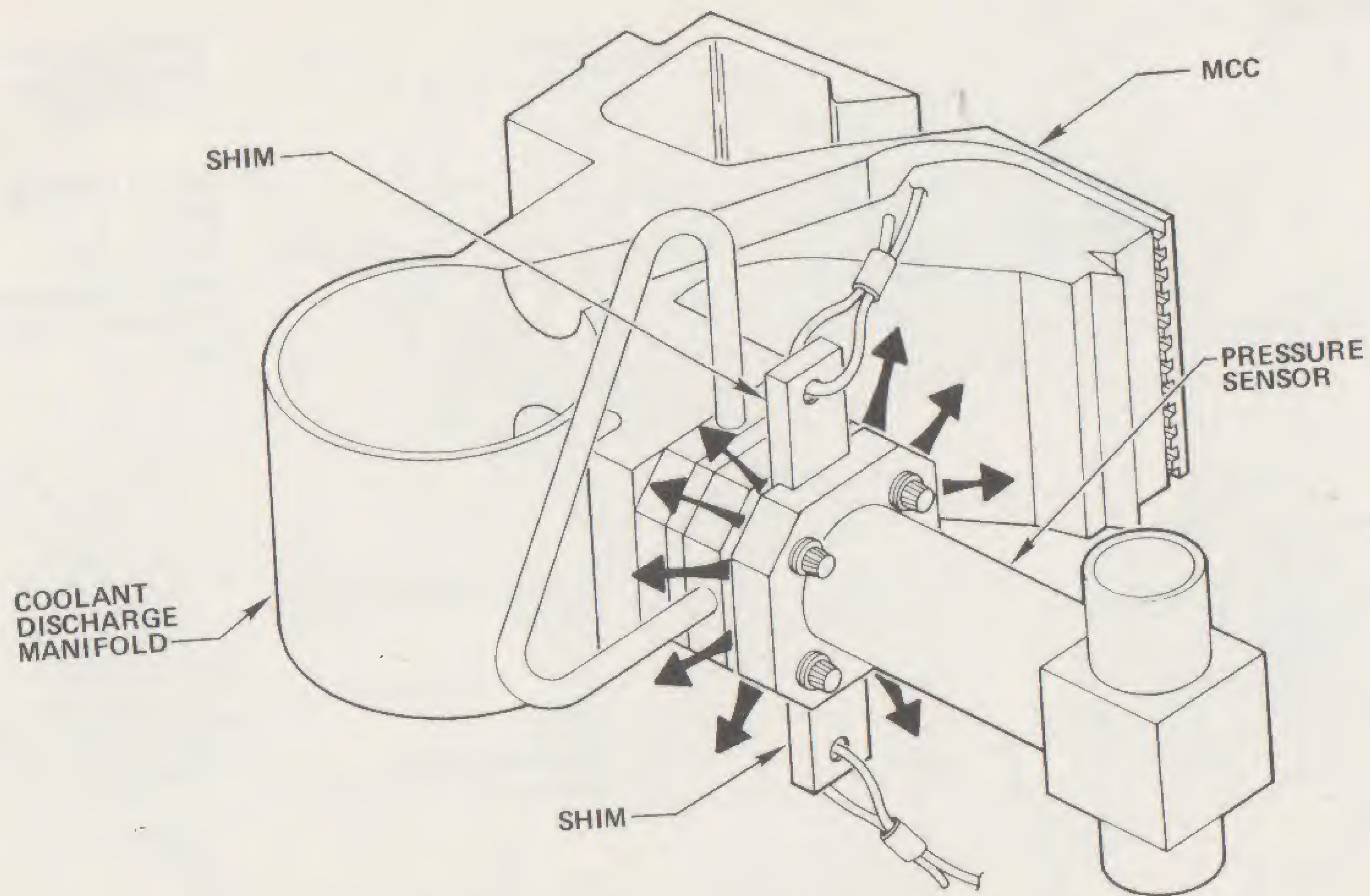


FIGURE 3-15. MCC COMBUSTION PRESSURE SENSOR DRYING USING SHIMS

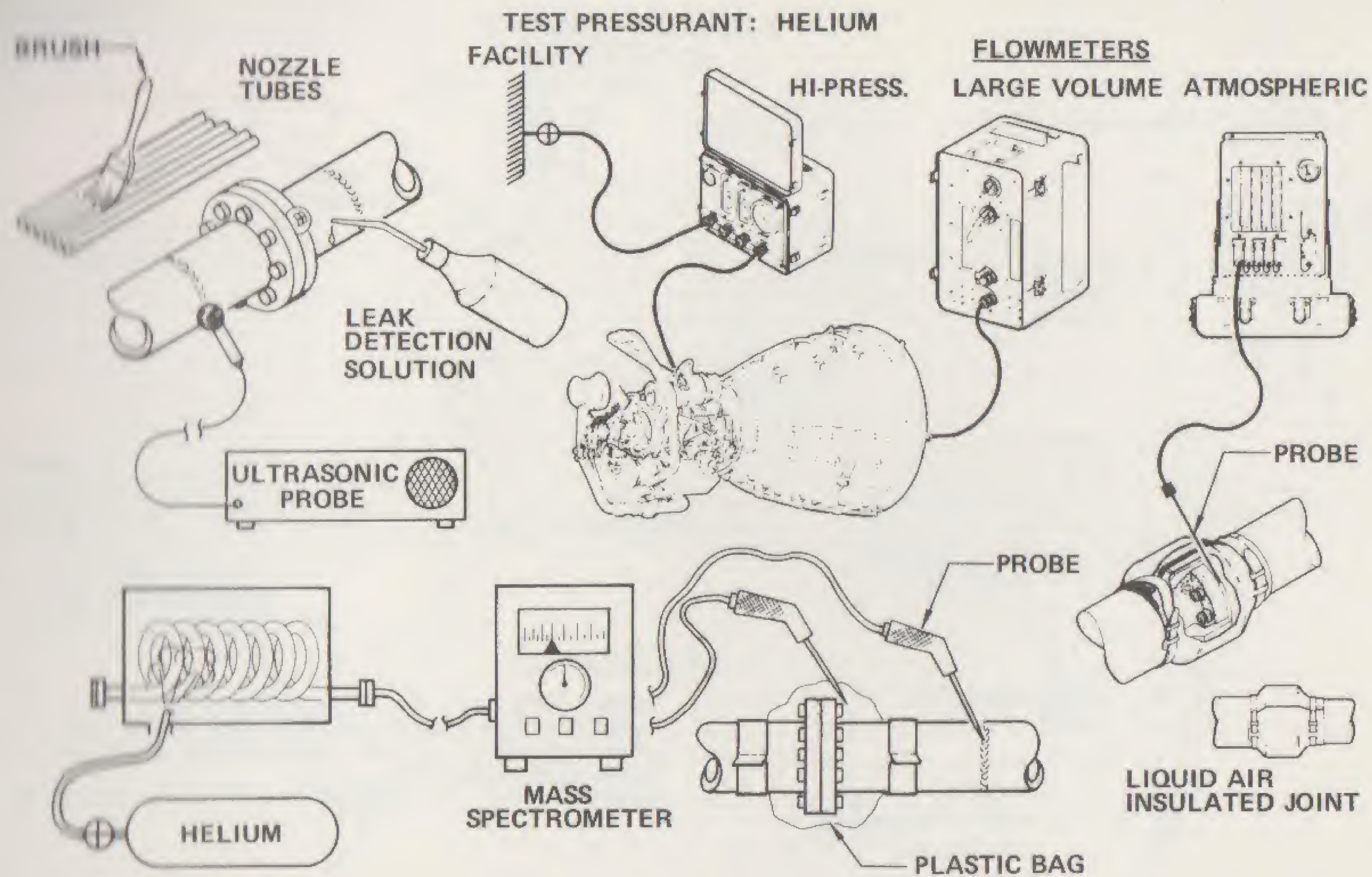
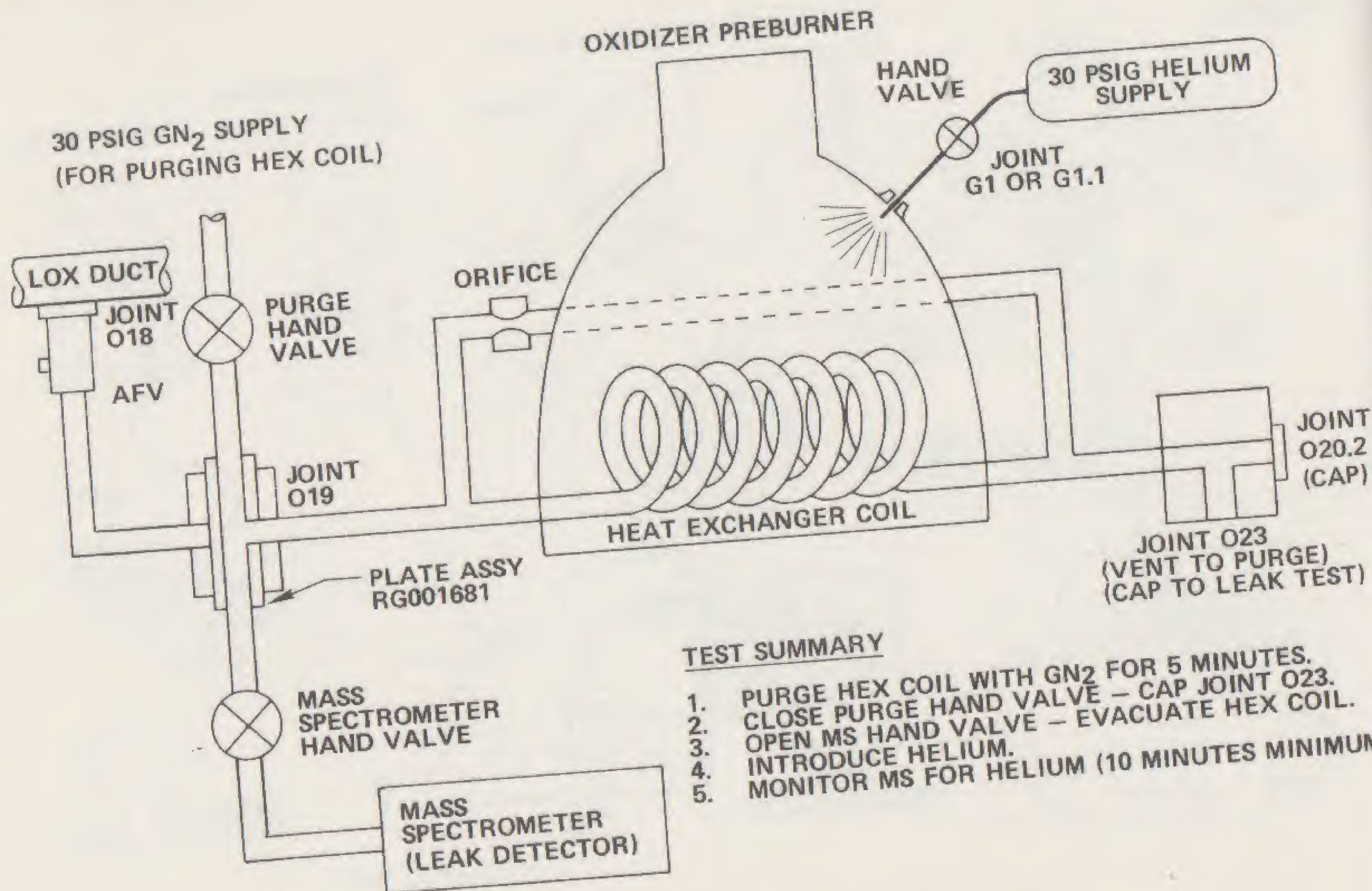


FIGURE 3-16. ENGINE LEAK TEST METHODS



TEST SUMMARY

1. PURGE HEX COIL WITH GN₂ FOR 5 MINUTES.
2. CLOSE PURGE HAND VALVE - CAP JOINT O23.
3. OPEN MS HAND VALVE - EVACUATE HEX COIL.
4. INTRODUCE HELIUM.
5. MONITOR MS FOR HELIUM (10 MINUTES MINIMUM).

FIGURE 3-17. HEAT EXCHANGER COIL LEAK TEST

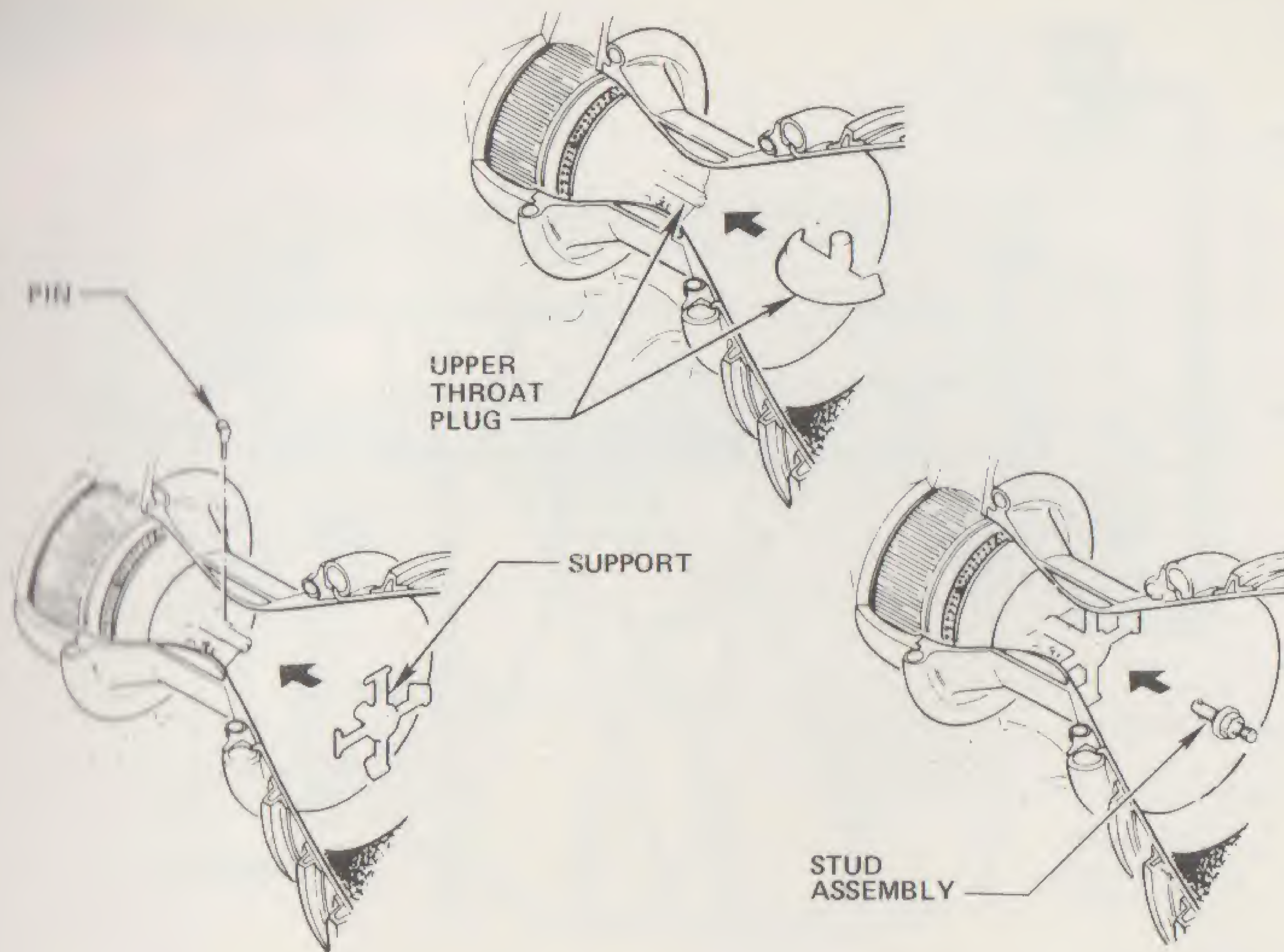


FIGURE 3-18. UPPER THROAT PLUG INSTALLATION

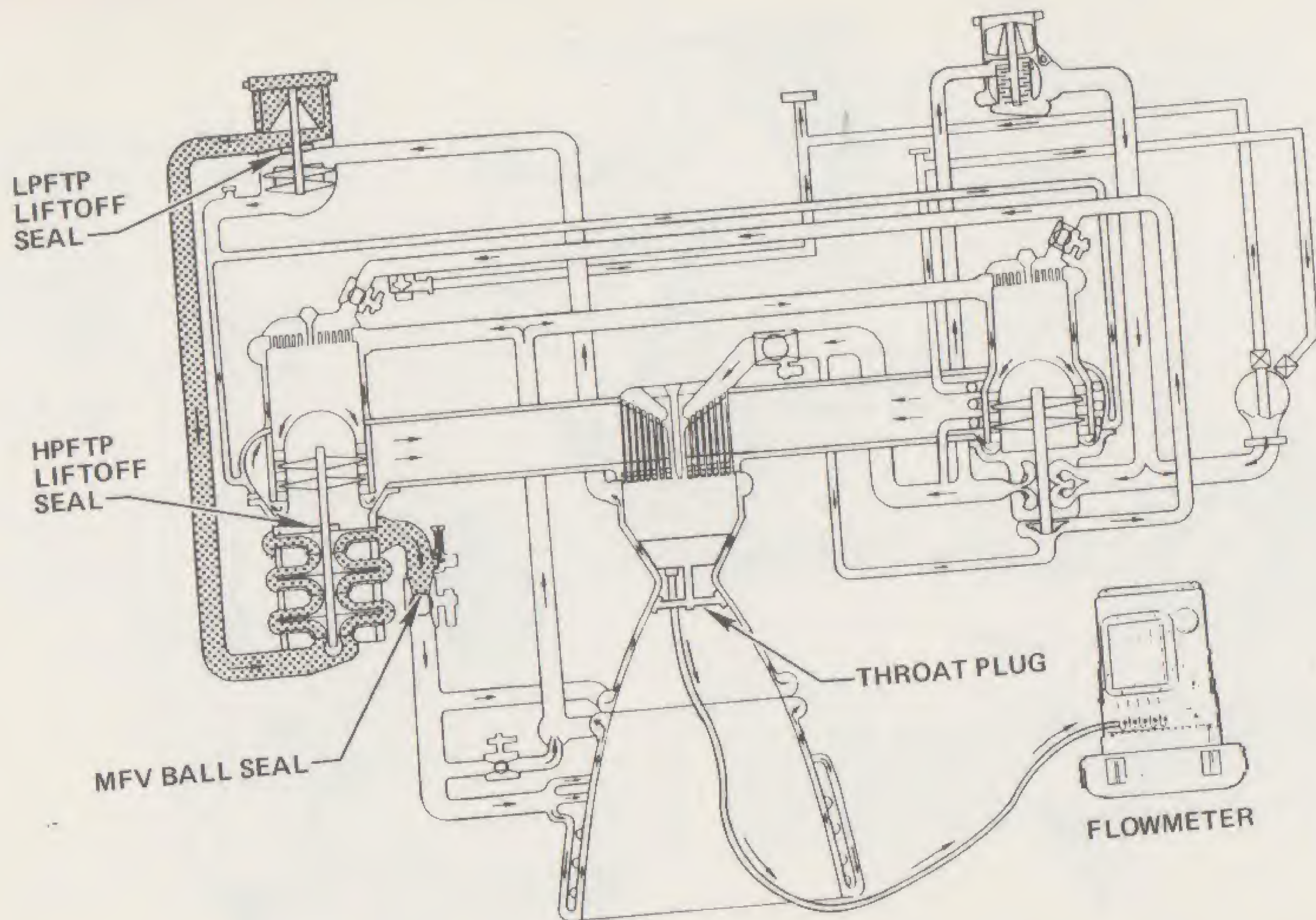


FIGURE 3-19. COMBINED LEAK TEST LPFTP AND HPFTP LIFTOFF SEALS AND MFV BALL SEAL

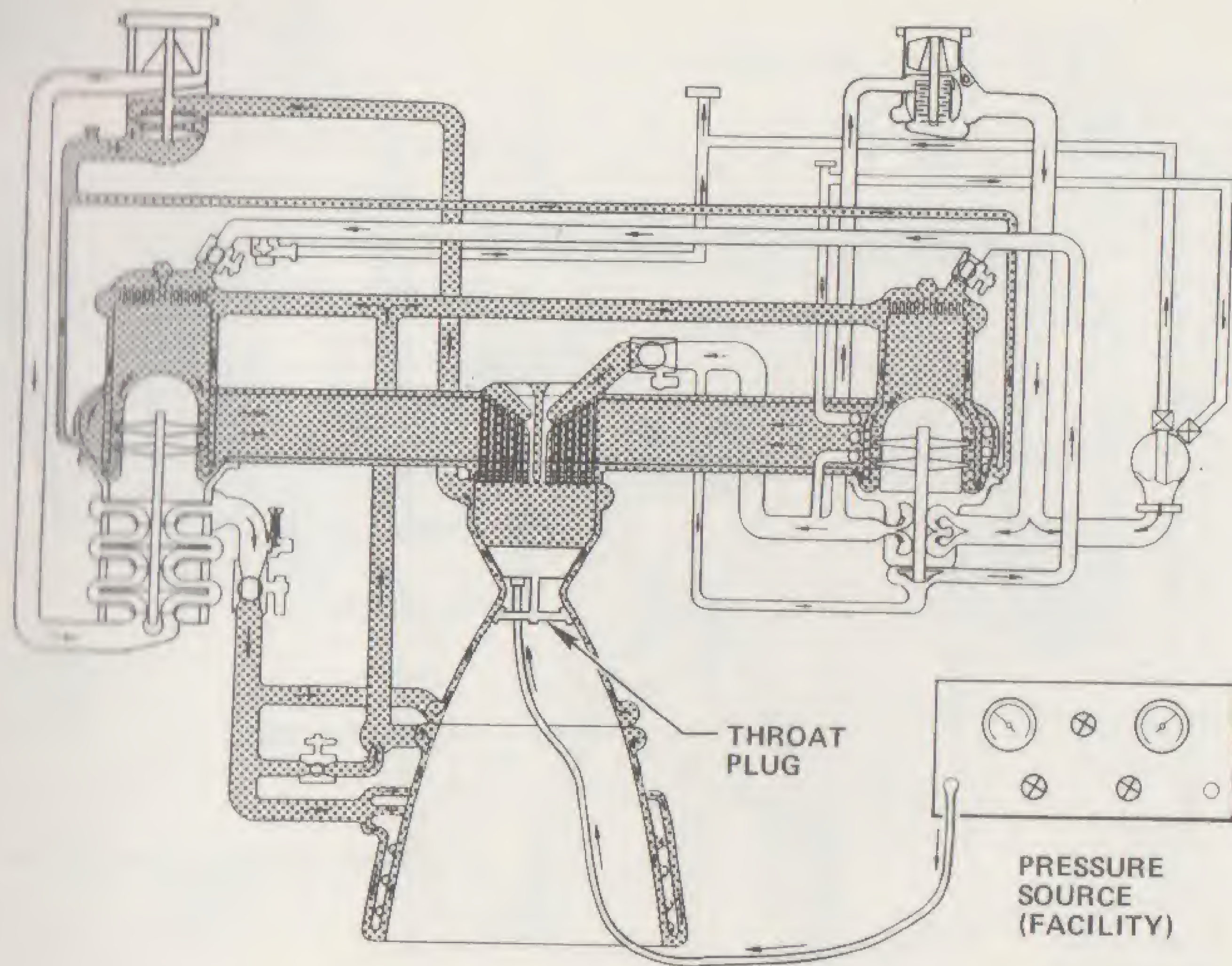


FIGURE 3-20. THRUST CHAMBER AND HOT-GAS SYSTEM LEAK TESTS

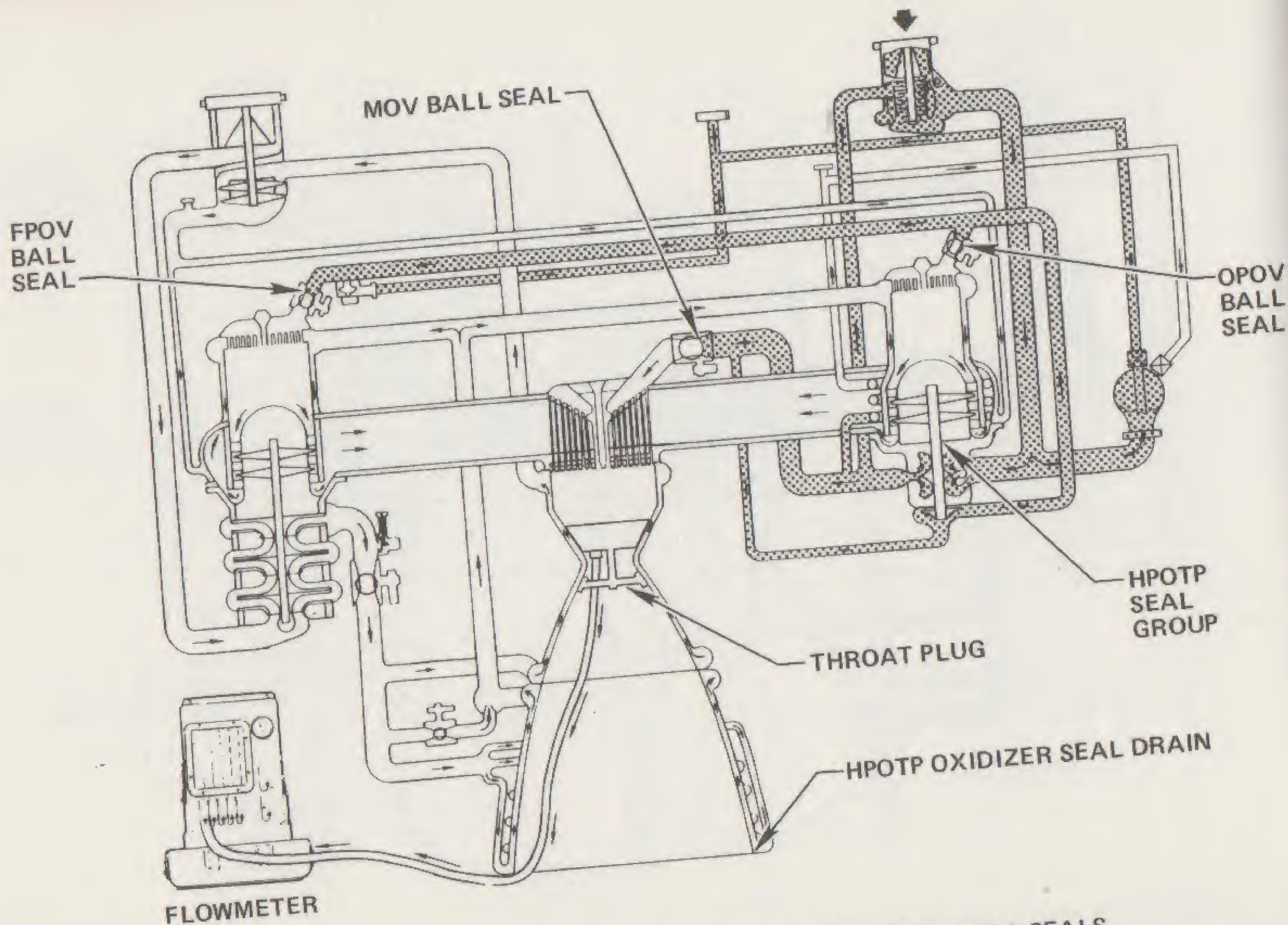


FIGURE 3-21. COMBINED LEAK TEST MOV, FPOV, OPOV BALL SEALS

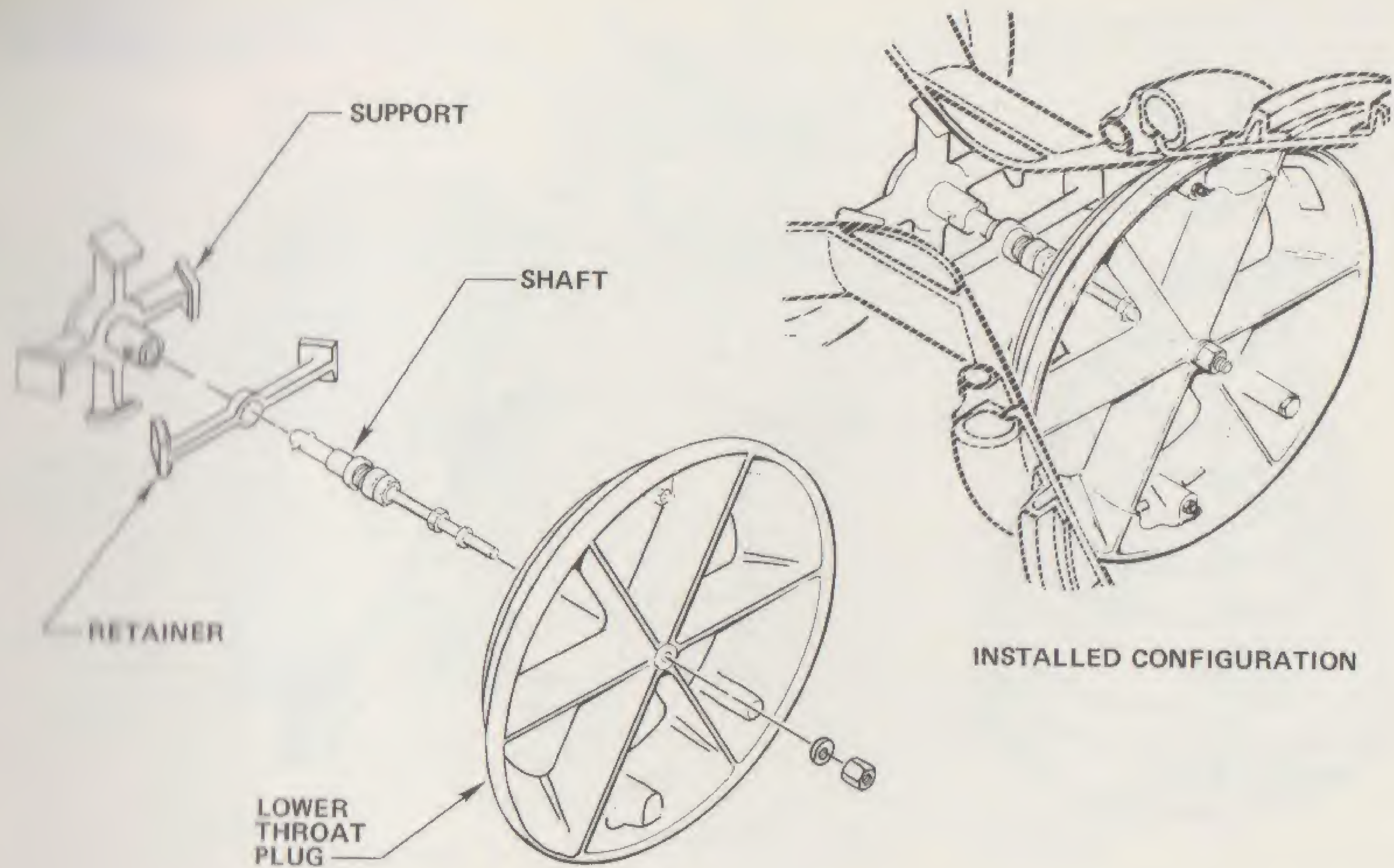


FIGURE 3-22. LOWER THROAT PLUG INSTALLATION

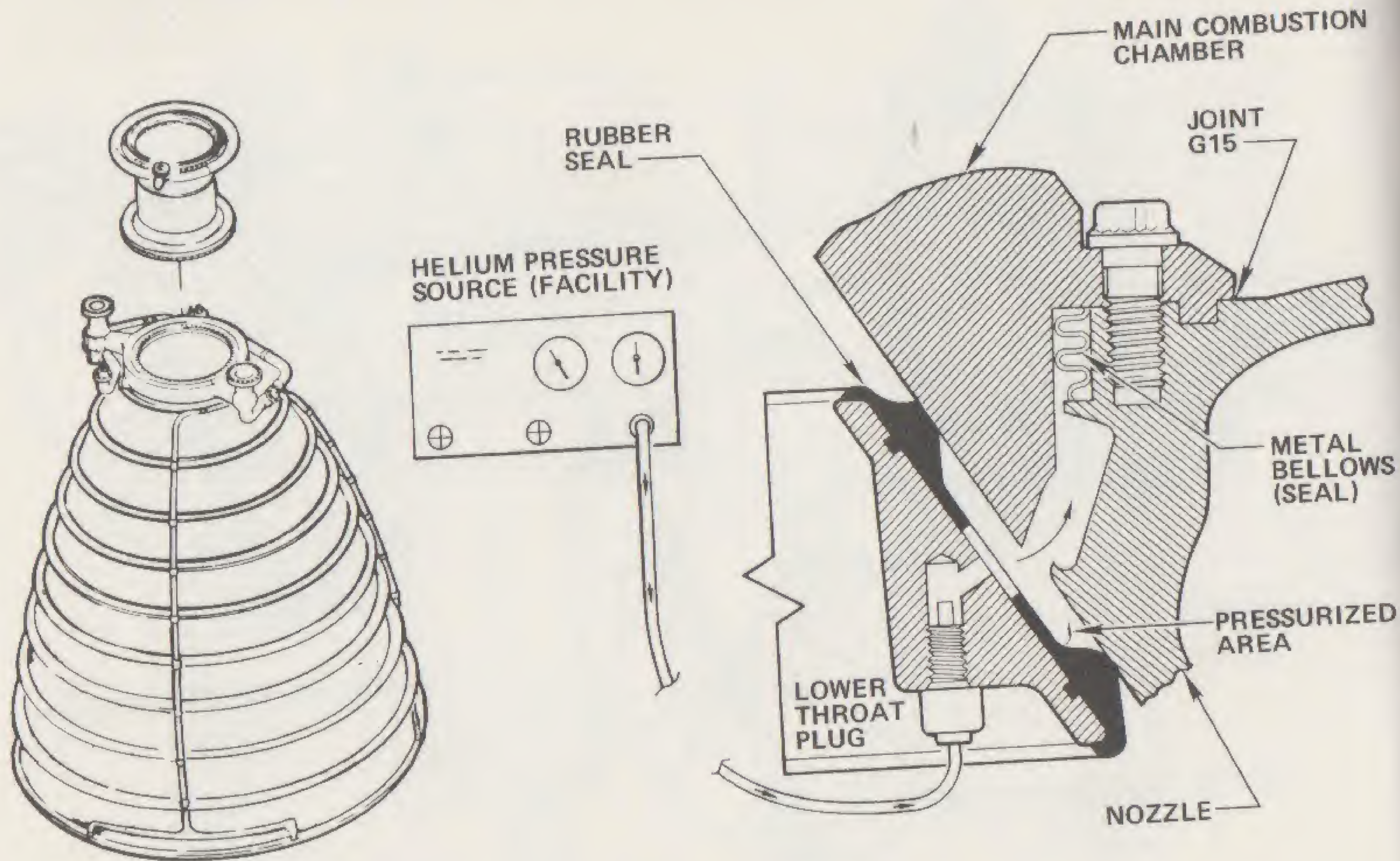


FIGURE 3-23. MCC - NOZZLE JOINT LEAK TEST

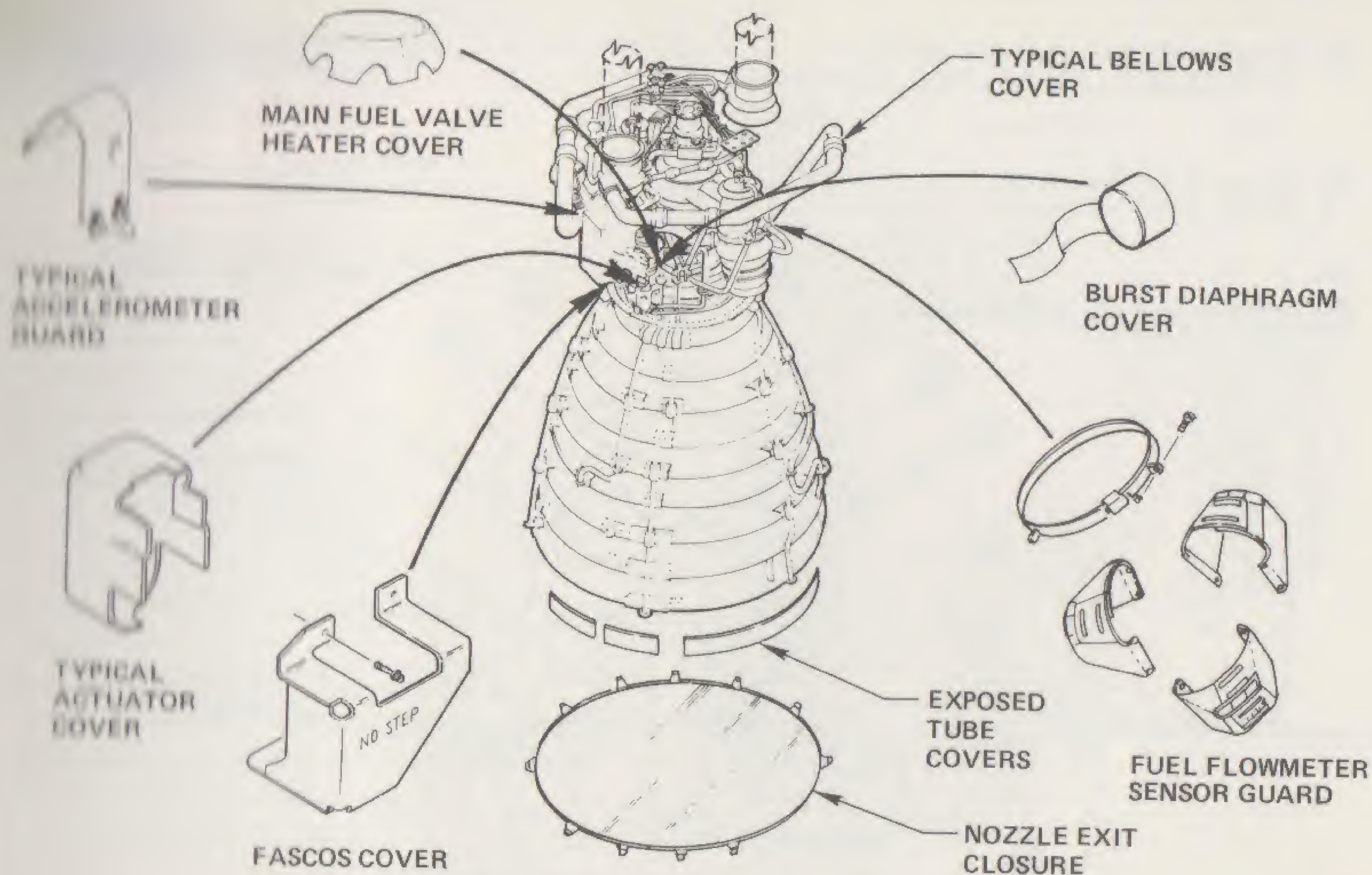


FIGURE 3-24. TYPICAL PROTECTIVE COVERS DURING MAINTENANCE

(A) HPOTP PRIMARY AND SECONDARY
TURBINE SEAL, DRAIN LINES (ADAPTERS)

(B) HPOTP OXIDIZER SEAL
DRAIN LINE (ADAPTER)

(C) COMPONENT OXIDIZER DRAIN
LINE (ADAPTER)

(D) COMPONENT FUEL
DRAIN LINE (ADAPTER)

(E) HYDRAULIC DRAIN LINE
(SCREW)

(F) MCC THROAT (PLUG)

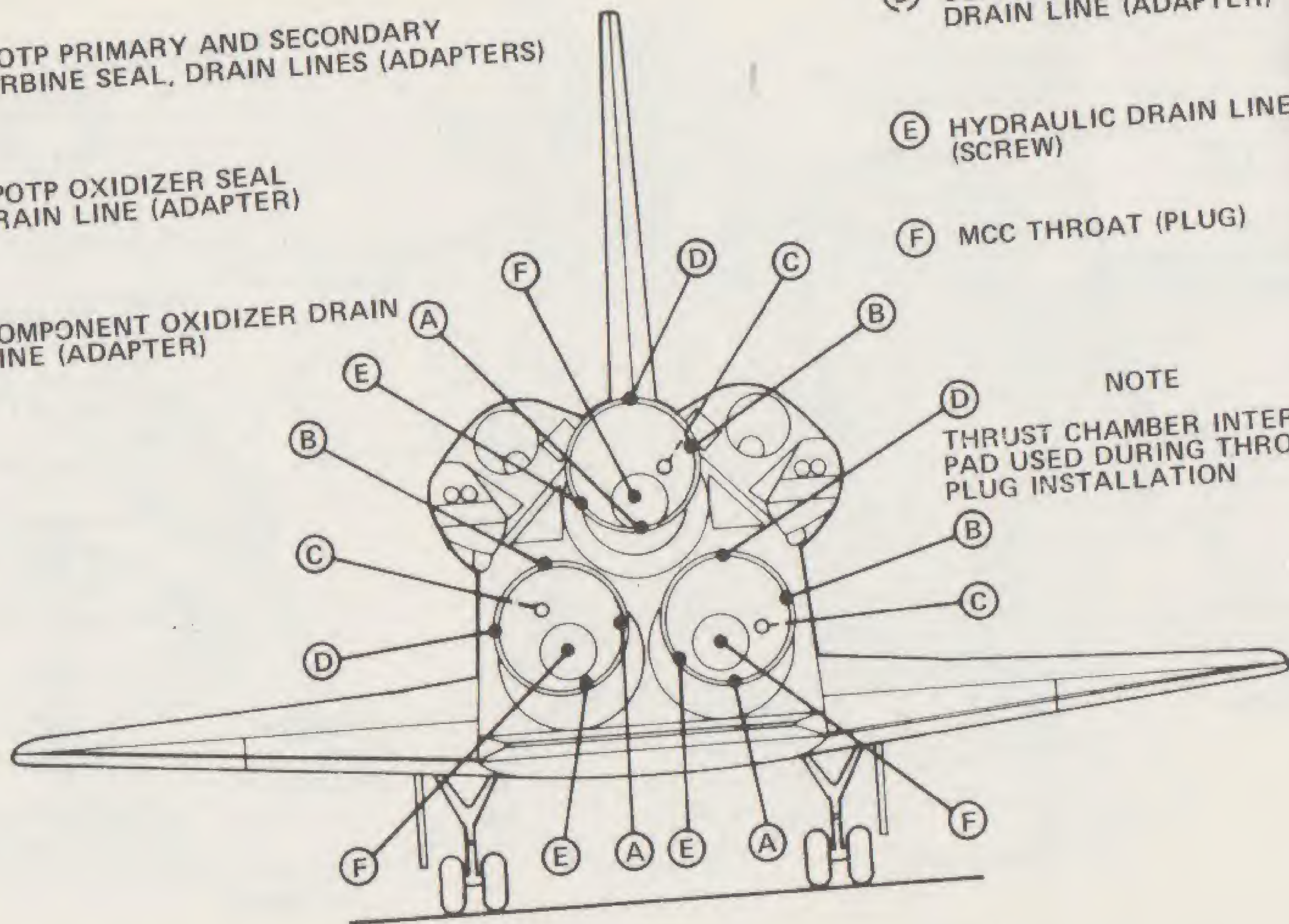


FIGURE 3-25. FERRY FLIGHT SET INSTALLATION POINTS

VERTICAL RAIL OPERATION

LEGEND

- 1 YAW CONTROL
- 2 FITCH CONTROL
- 3 ELEVATION CONTROL
- 4 AZIMUTH CONTROL
- 5 ROLL CONTROL
- 6 TROLLEY DRIVE WINCH
- 7 ELEVATOR TRACK WINCH
- 8 TROLLEY TO ELEVATOR TRACK ROLLERS (8)
- 9 TROLLEY RAILS (2)
- 10 ELEVATOR STANCHION CASTORS (4)
- 11 ELEVATOR TRACK SLEW DRIVE CONTROL
- 12 ELEVATOR TRACK PITCH DRIVE CONTROL
- 13 PITCH CONTROL COVERS (2)
- 14 ROLL CONTROL COVERS (2)

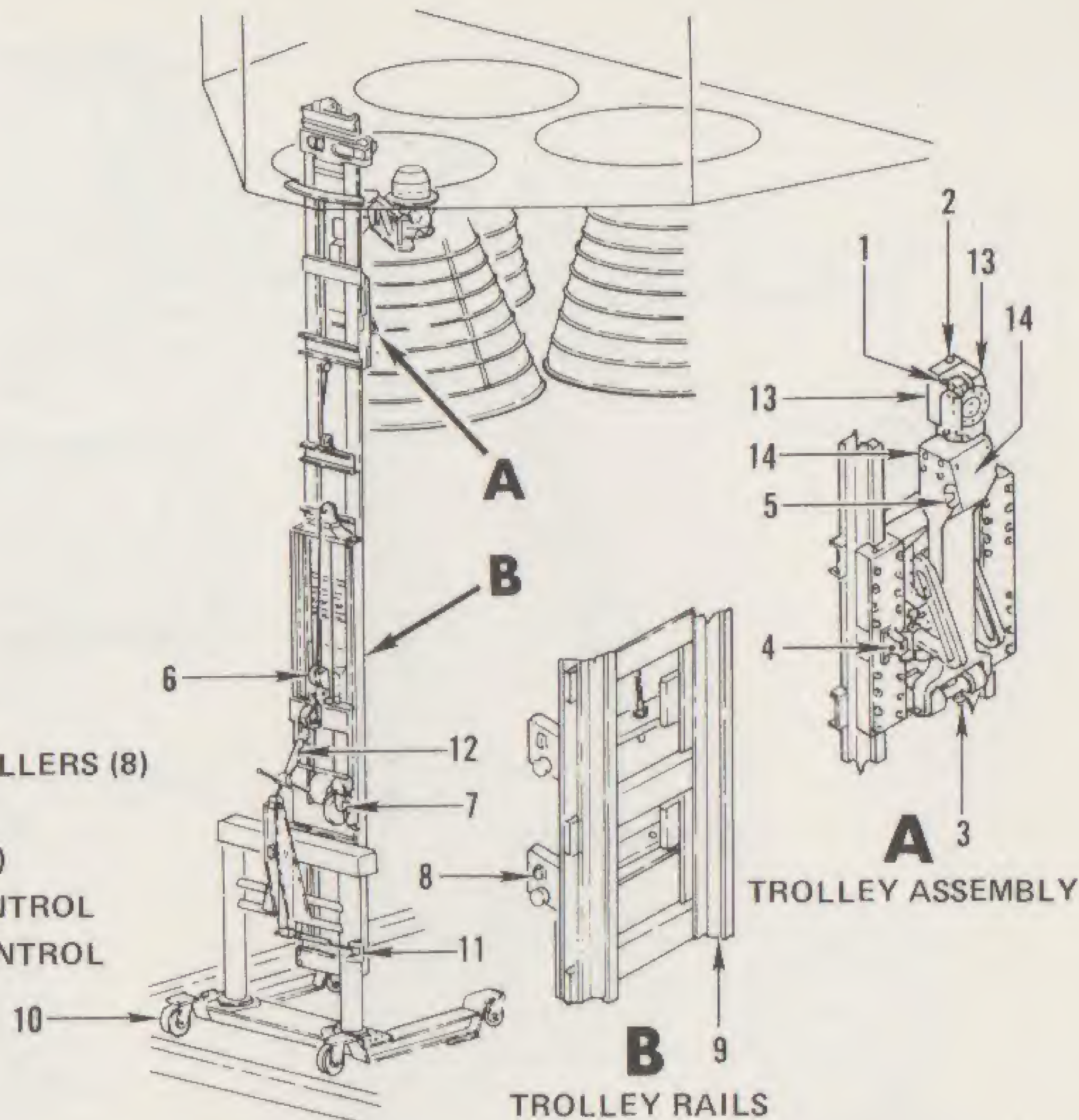


FIGURE 3-26. VERTICAL RAIL OPERATION

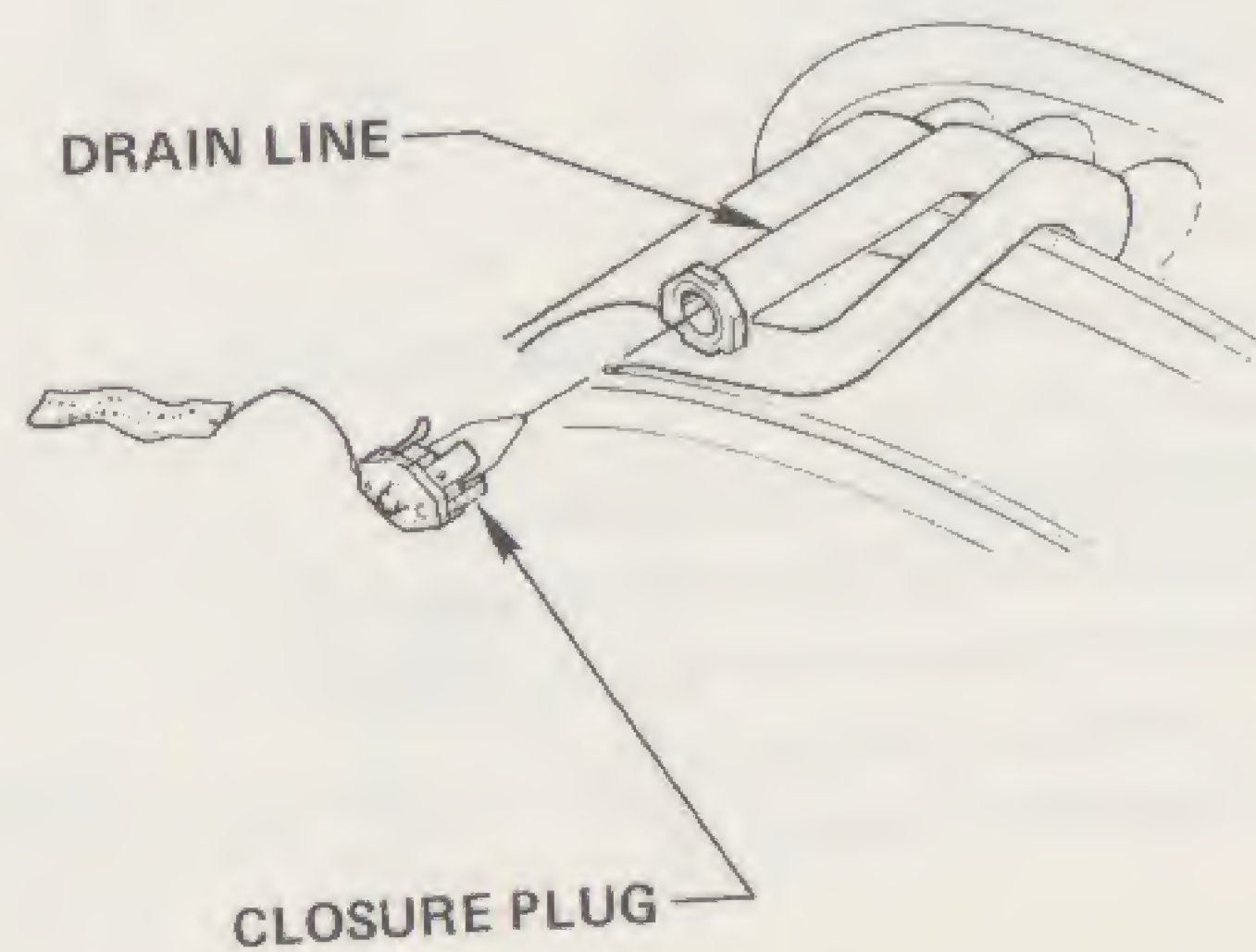
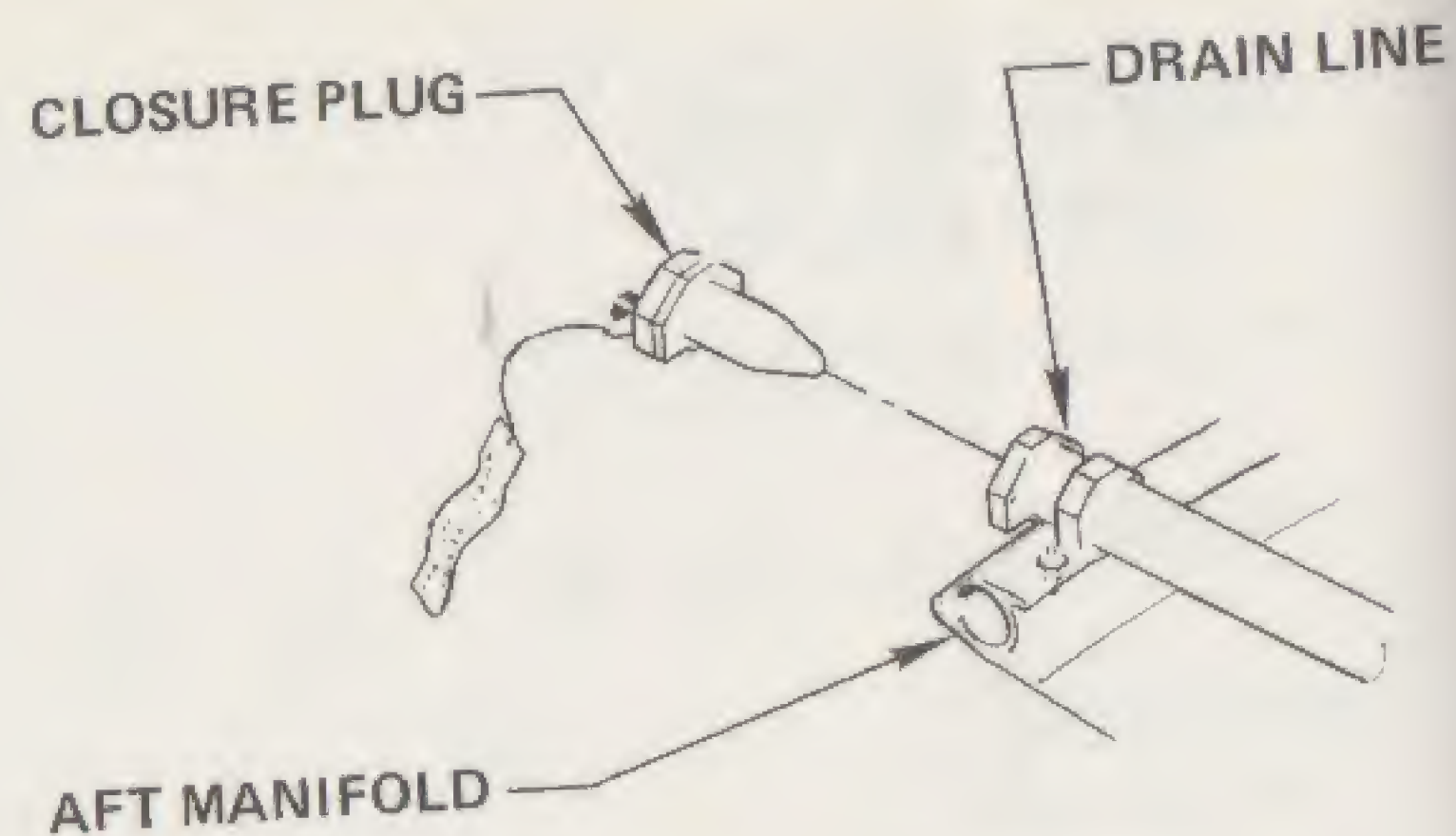
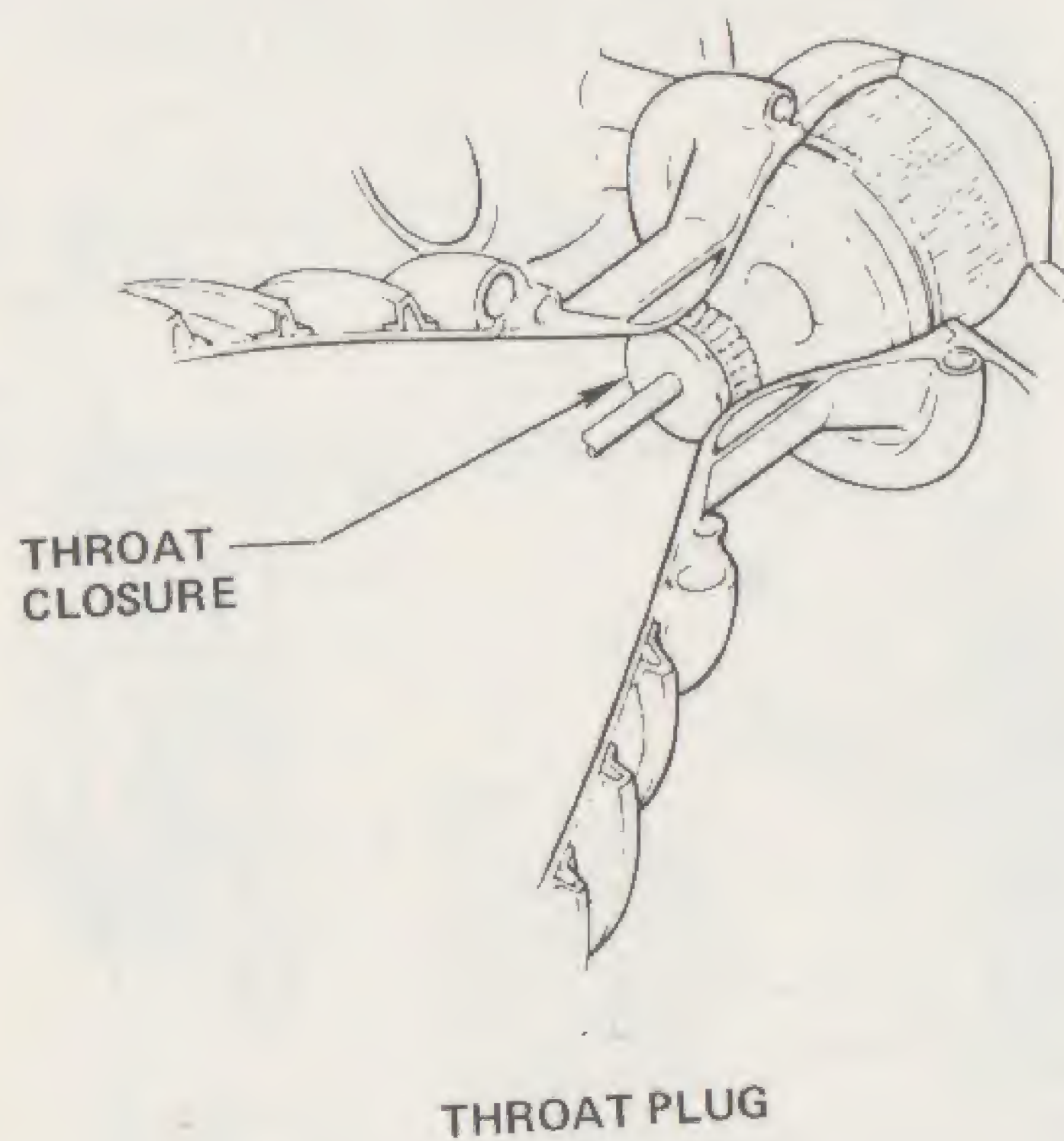


FIGURE 3-27. ENVIRONMENTAL CLOSURE APPLICATIONS

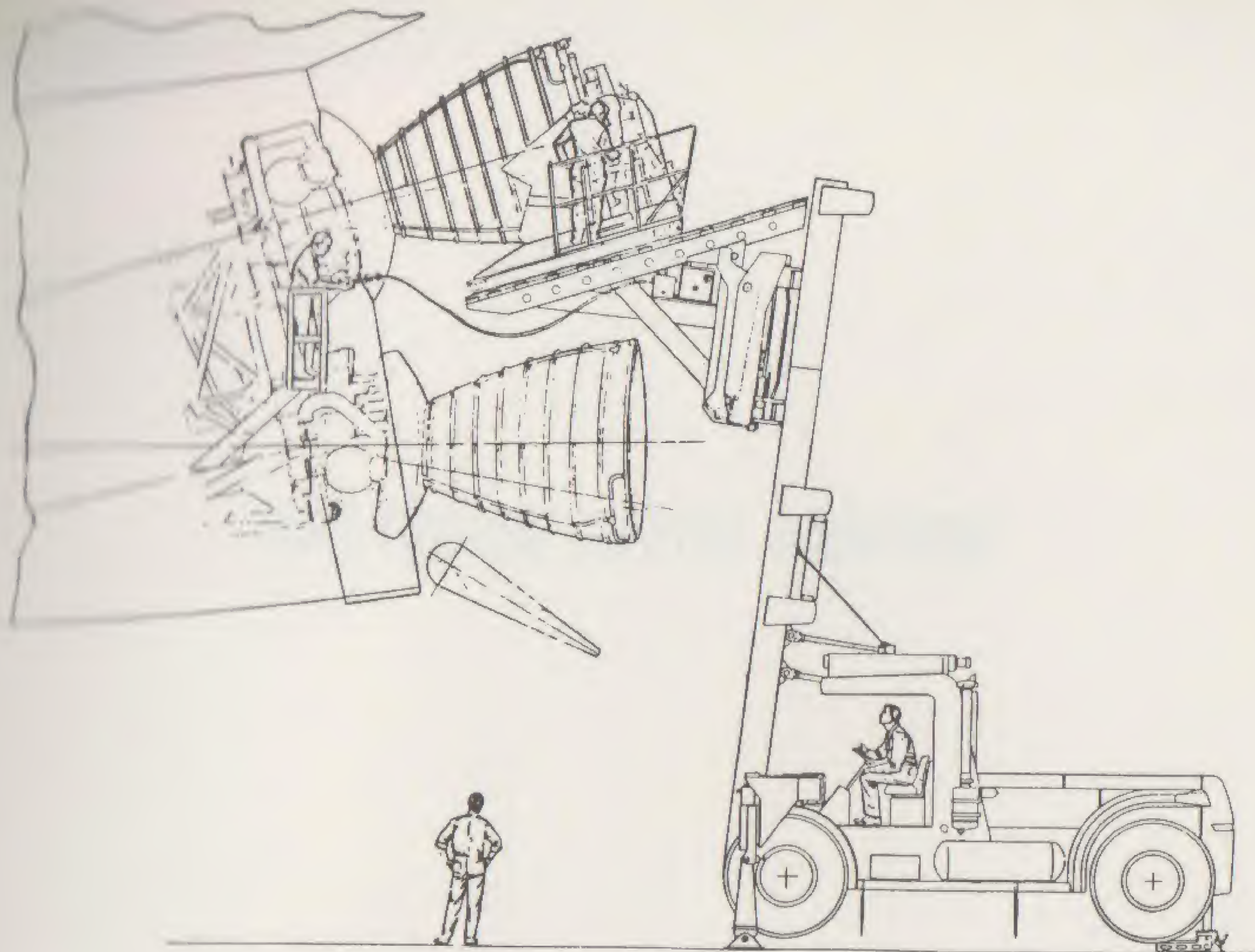


FIGURE 3-28. HORIZONTAL ENGINE REMOVAL

SECTION IV

SSME GROUND SUPPORT EQUIPMENT

NOMENCLATURE	PROGRAM CODE	NOMENCLATURE	PROGRAM CODE
<u>TEST EQUIPMENT</u>		<u>PROTECTION EQUIPMENT</u>	
SCHEDULED ENGINE LEAK	C70-0914	THRUST CHAMBER PROTECTIVE	S70-0903
TEST SET RG2527A, RG000013		PAD RG2515A, RG000010	
UNSCHEDULED ENGINE LEAK	C70-0915	ENVIRONMENTAL PROTECTION COVER	S70-0902
TEST SET RG2526A, RG000012		SET RG2513A, RG000008	
ENGINE INTERFACE TEST PLATE	C70-0916	FERRY FLIGHT SET RG2537A,	C70-0909
SET RG2576A, RG000400		RG000023	
PNEUMATIC (ATMOSPHERIC) FLOW	C70-0903	NOZZLE BUMPER SET RG2578A,	S70-0910
TESTER RG2528A, RG000014		RG000463	
LARGE VOLUME FLOW TESTER	C70-0908	<u>HANDLING EQUIPMENT</u>	
RG2536A, RG003046		ENGINE HANDLER RG2502A,	H70-0901
HIGH-PRESSURE PNEUMATIC FLOW	C70-0904	RG000001	
TESTER RG2529A, RG000015		ENGINE HANDLER SLING RG2505A,	H70-0902
DCU MEMORY LOADER RG2553A	C70-0910	RG000003	
UG8629A2		COMPONENT HANDLER SLING SET	H70-0905
ELECTRICAL CHECKOUT AND	C70-0912	RG2514A, RG000009	
MAINTENANCE SET RG2538A, RG000018		VERTICAL ENGINE INSTALLER SET	H70-0774-1
ENGINE SIMULATOR WEIGHT RG2581A,	S70-0911	RG2507A, RG000327	
RG003010		ENGINE ROTATING SLING RG2506A,	H70-0903
MULTIPLE GAS ANALYZER ASSEMBLY	C70-0917	RG000004	
RG2577A, RG000480		INTERFACE PANEL AND STRUT SET	H70-0911
COMMAND AND DATA	C70-0906	RG2518A, RG000350	
SIMULATOR II RG2584A, RG000521		HIGH-PRESSURE FUEL TURBOPUMP	H70-0906
<u>INSPECTION EQUIPMENT</u>		SHIPPING CONTAINER ASSEMBLY	
INTERNAL INSPECTION SET RG2575A,	C70-0907	RG2591A, RG000438	
RG000020		HIGH-PRESSURE OXIDIZER TURBOPUMP	H70-0907
<u>MAINTENANCE EQUIPMENT</u>		SHIPPING CONTAINER ASSEMBLY	
SPECIAL TOOL SET RG2531A,	S70-0905	RG2592A, RG000441	
RG000017		LOW-PRESSURE TURBOPUMP SHIPPING	H70-0908
MAINTENANCE AND REPAIR SET	S70-0908	CONTAINER ASSEMBLY	
RG2539A, RG000024		RG2593A, RG000442	
INTERFACE SEAL REMOVAL/ INSTALLATION SET RG2517A,	S70-0909		
RG000199			

FIGURE 4-1. GROUND SUPPORT EQUIPMENT LIST

(C70-0914) (RG2527A) (RG000013)

SANDWICH-TYPE TEST PLATE

TEST PORT ADAPTER

FPB COMBUSTION
CHAMBER ADAPTER

OBV SEAT LEAKAGE
TEST PLATE

TRANSDUCER PURGE SEAL
RETAINER TOOL

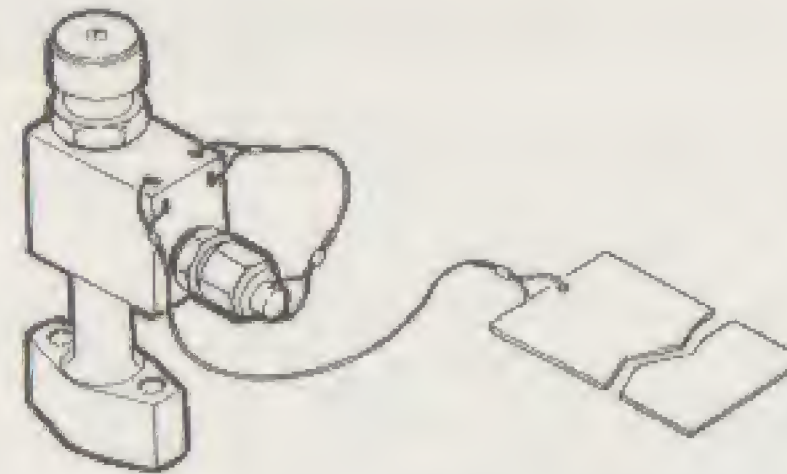
ENGINE THROAT PLUG SET

PURPOSE: PROVIDE AN INTERFACE FOR GSE AND CONTAIN PNEUMATIC PRESSURES IN
ENGINE SYSTEMS DURING LEAK AND FUNCTION TESTS OF INSTALLED ENGINES.

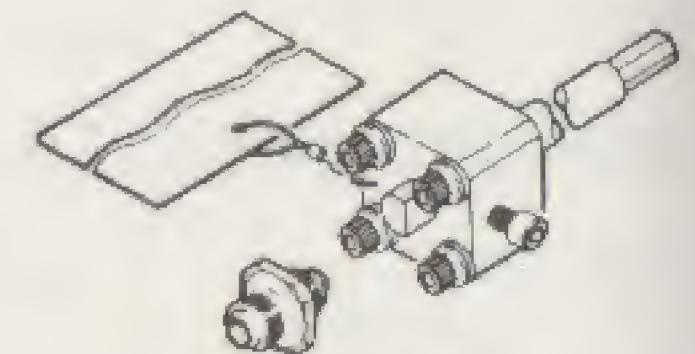
FIGURE 4-2. SCHEDULED ENGINE LEAK TEST SET (SHEET 1 OF 2)



CONTAINER (TYP)



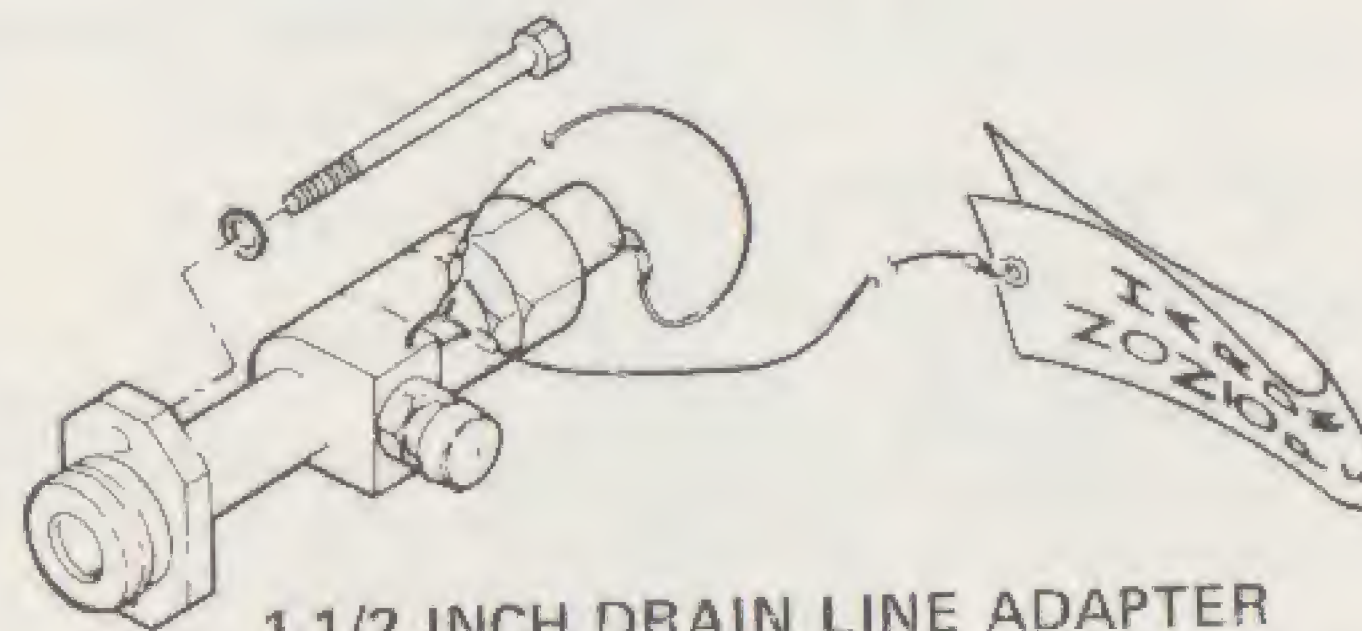
RIV ADAPTER



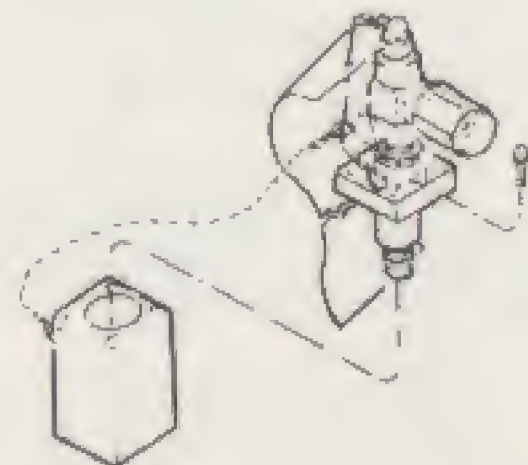
MCC AND NOZZLE PURGE SET



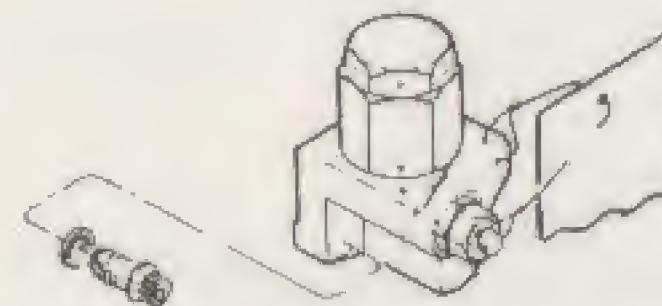
HOSE SET



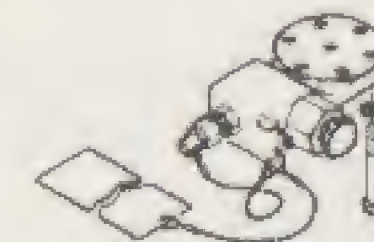
1-1/2 INCH DRAIN LINE ADAPTER



ANTIFLOOD VALVE
TEST SET



HPOTP AND HPFTP
PURGE ADAPTERS
(TYP)



HEAT EXCHANGER
PLATE SET

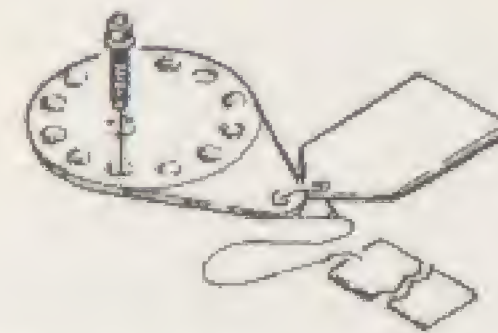


FIGURE 4-2. SCHEDULED ENGINE LEAK TEST SET (SHEET 2 OF 2)

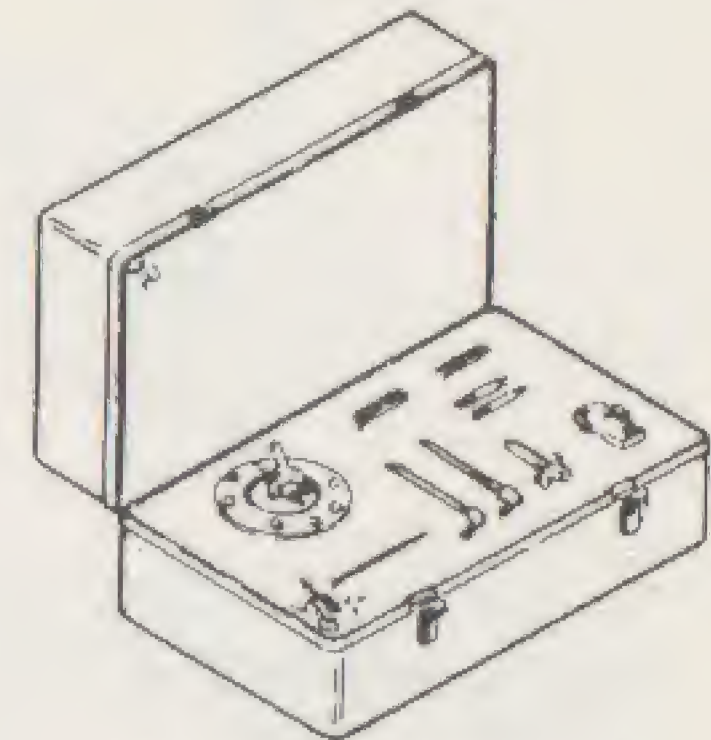
(C70-0915) (RG2526A) (RG000012)



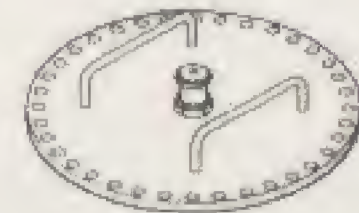
COMMON PREBURNER
PURGE PLATE (2)



PREBURNER PUMP
DISCHARGE PLATE



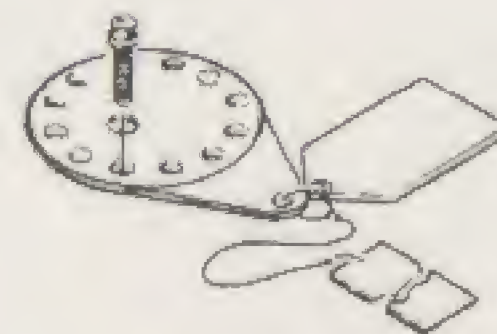
INLET DUCT MFV
PLATE SET



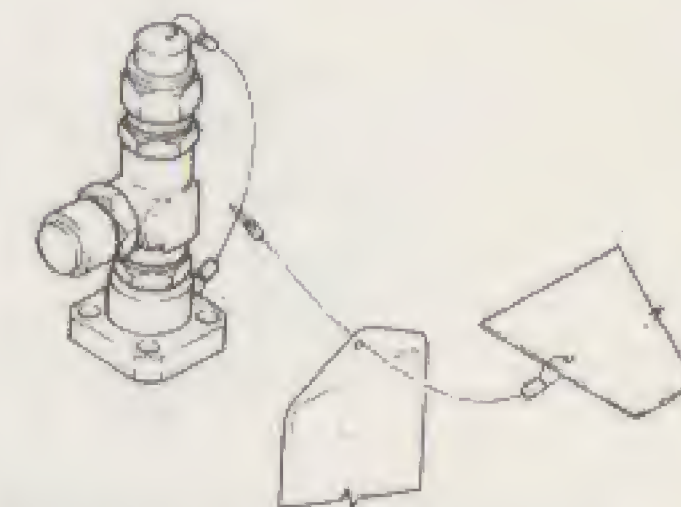
G3 OXIDIZER PLATE SET
G6 FUEL PLATE SET



LPETP DISCHARGE
TEST PLATE



FPOV SUPPLY
TEST PLATE

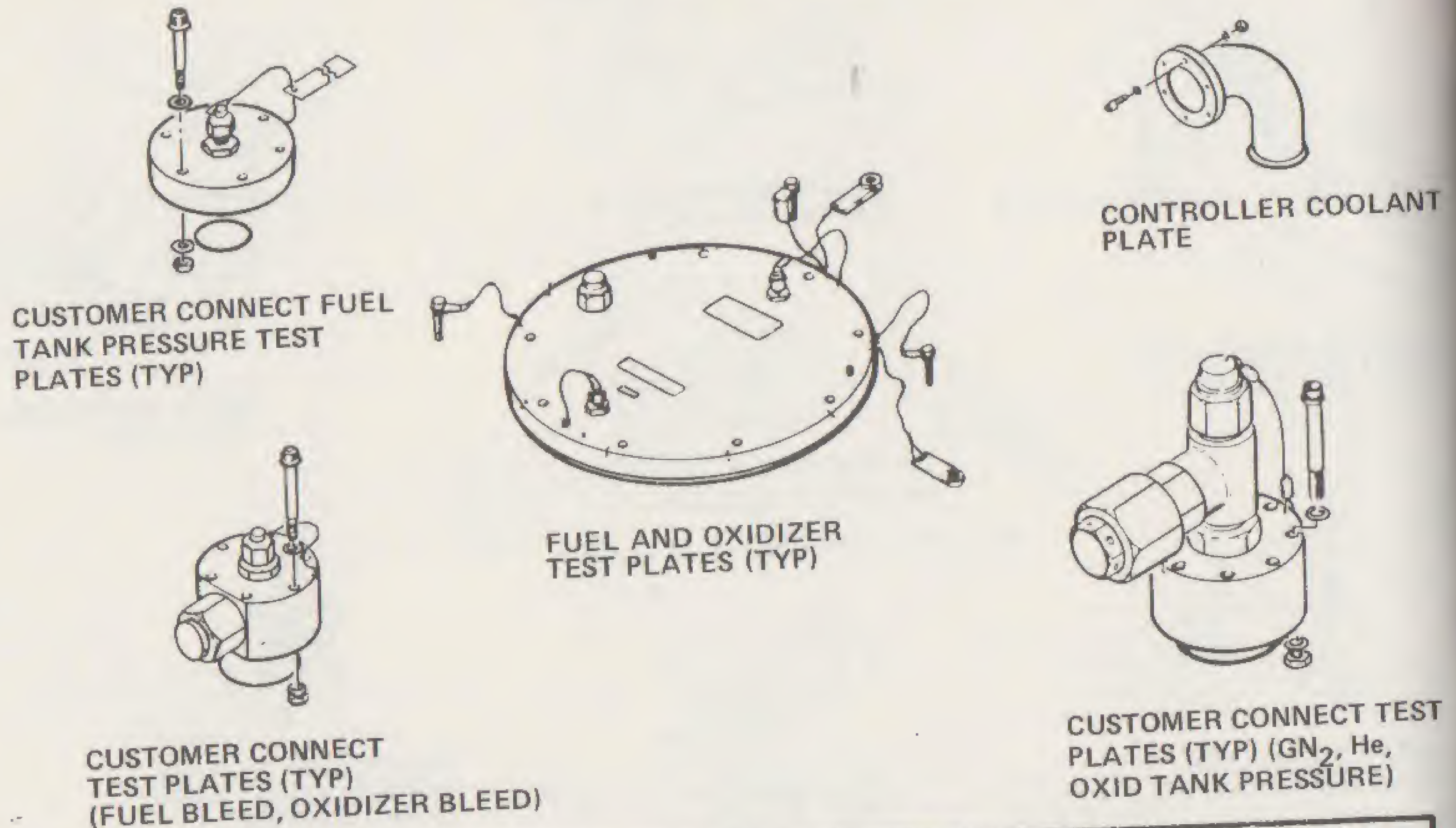


PREBURNER VALVES
DOWNSTREAM LEAK
TEST ADAPTER

PURPOSE: PROVIDE AN INTERFACE FOR GSE AND CONTAIN PNEUMATIC PRESSURES IN ENGINE SYSTEMS DURING PERIODIC OR ISOLATION LEAK AND FUNCTION TESTS.

FIGURE 4-3. UNSCHEDULED ENGINE LEAK TEST SET

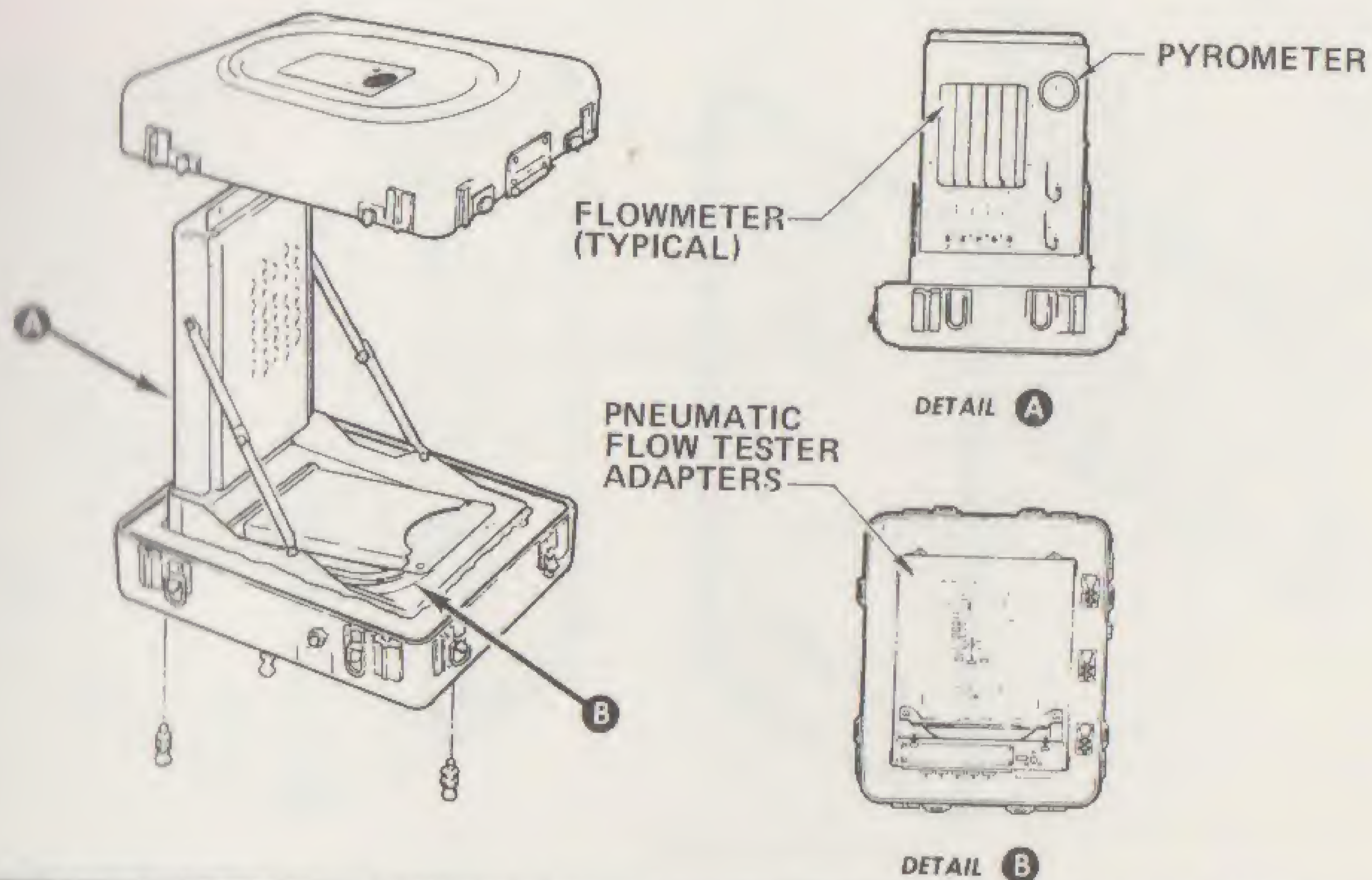
(C70-0916) (RG2576A) (RG000400)



PURPOSE: PROVIDE AN INTERFACE FOR GSE AND CONTAIN PNEUMATIC PRESSURE IN ENGINE SYSTEMS DURING LEAK AND FUNCTION TESTS OF UNINSTALLED ENGINES.

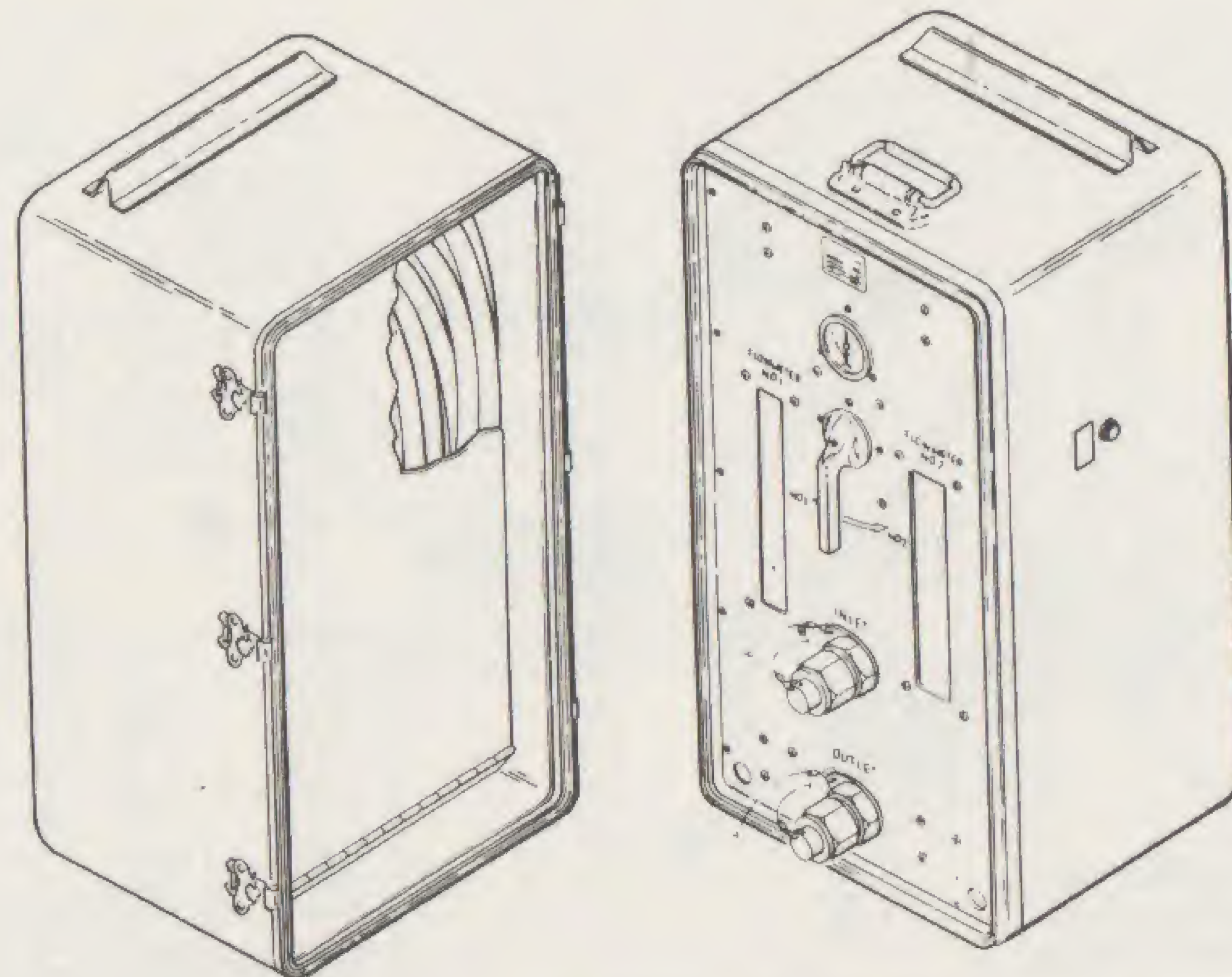
FIGURE 4-4. ENGINE INTERFACE TEST PLATE SET

(C70-0903) (RG2528A) (RG000014)



PURPOSE: MEASURE PNEUMATIC LEAKAGE FROM COMPONENTS AND SYSTEMS DURING LEAK TESTS (VENTS TO ATMOSPHERE).

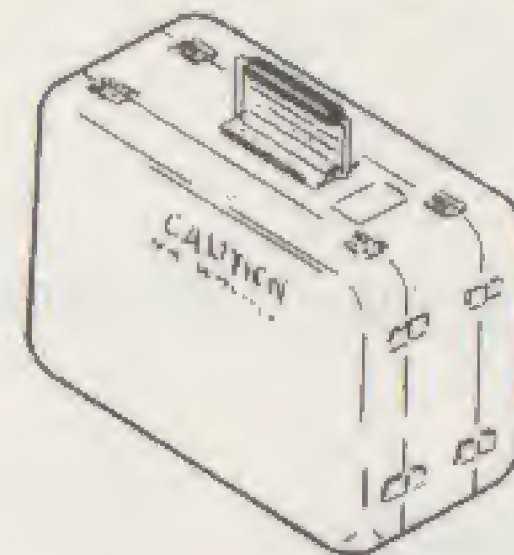
FIGURE 4-5. PNEUMATIC (ATMOSPHERIC) FLOW TESTER



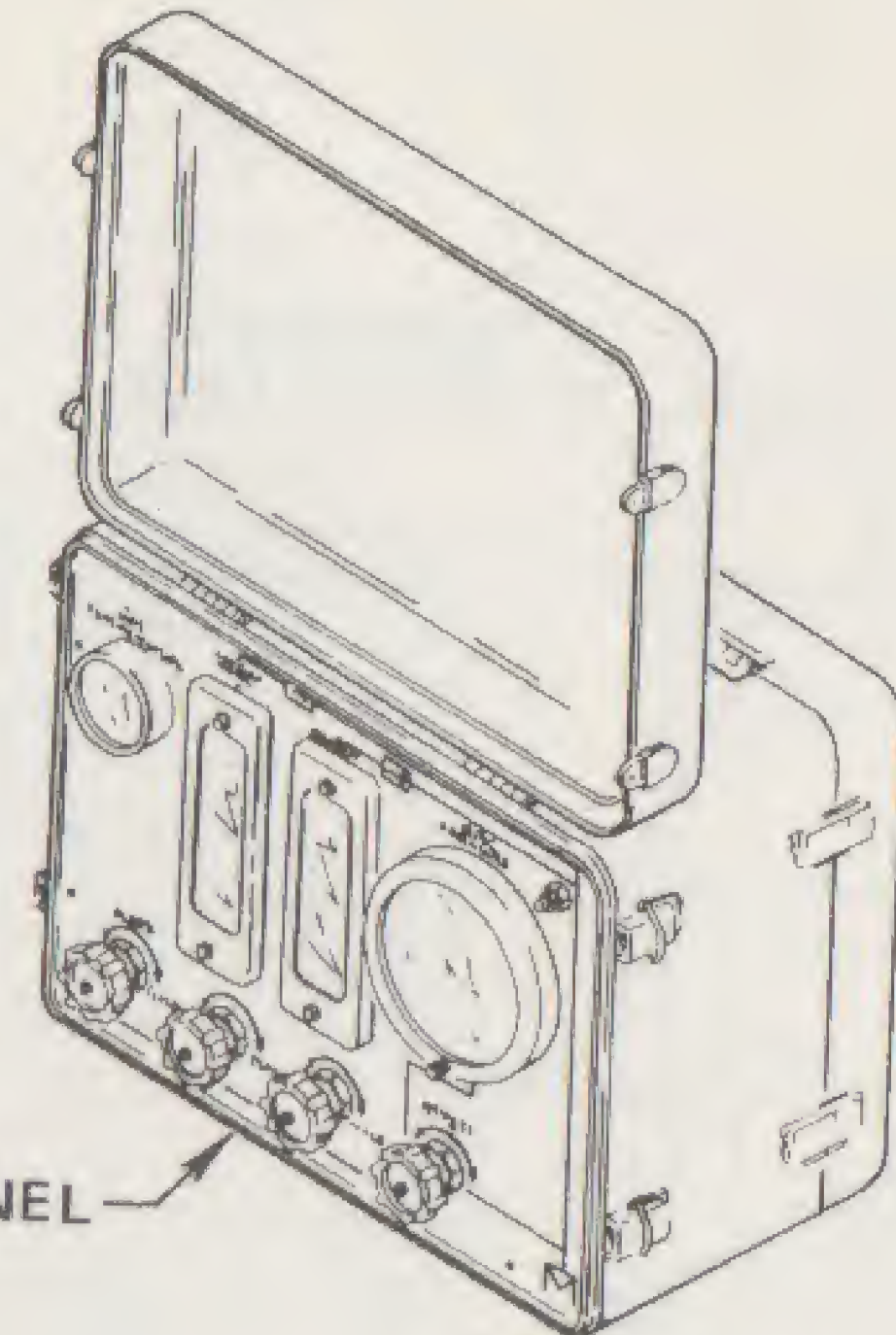
PURPOSE: MEASURE PNEUMATIC FLOWS PAST HIGH-PRESSURE OXIDIZER TURBOPUMP SEALS DURING LEAK TESTS.

FIGURE 4-6. LARGE VOLUME FLOW TESTER

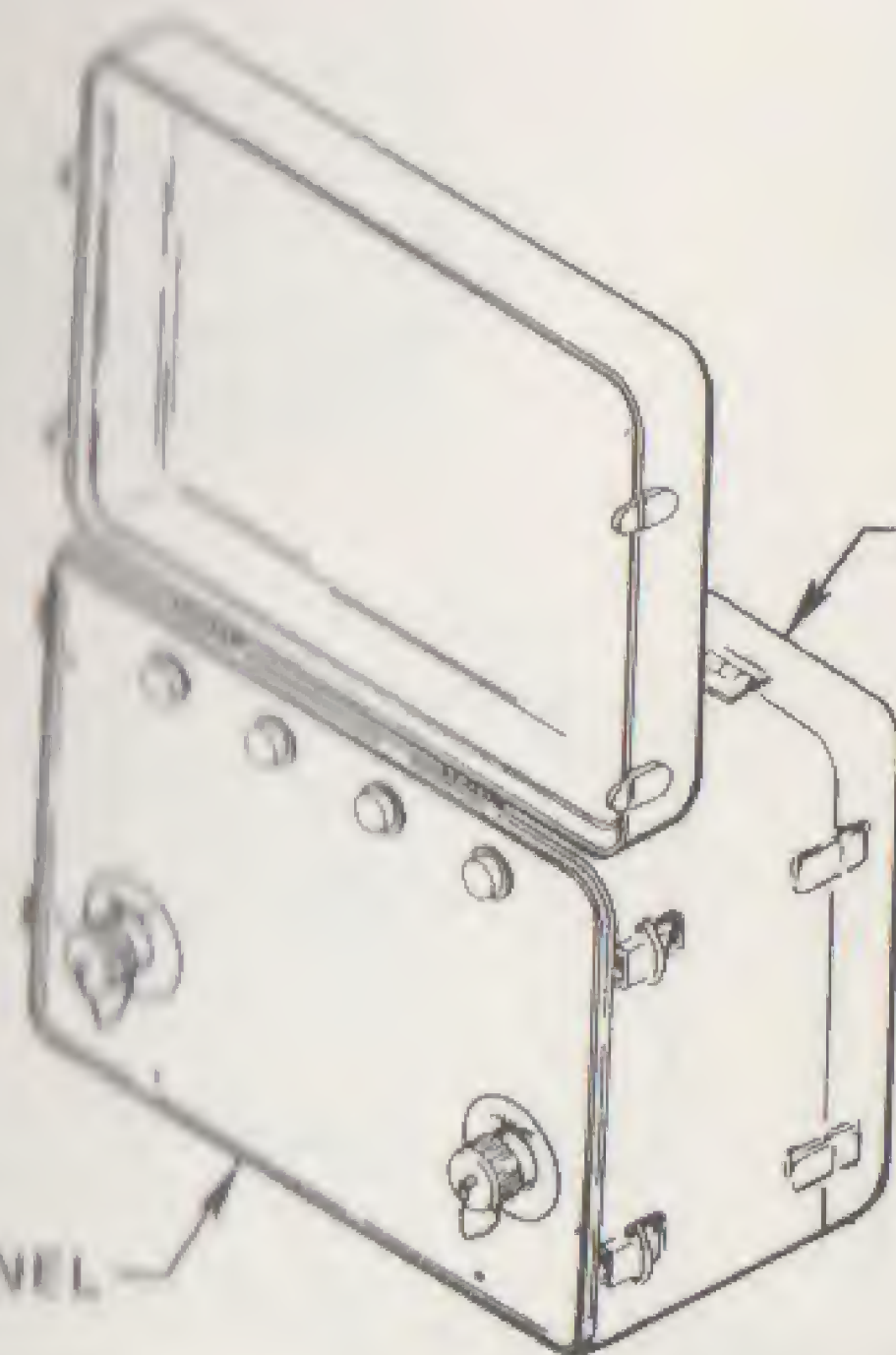
(C70-0904) (RG2529A) (RG000015)



PNEUMATIC TESTER

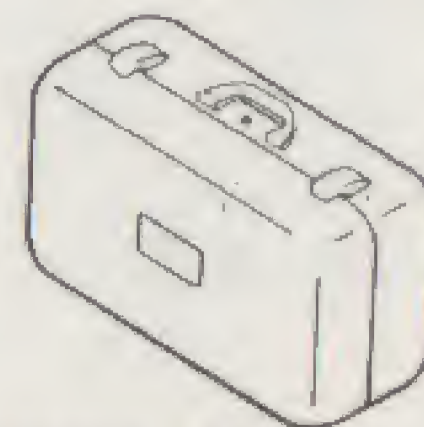


FRONT PANEL



BACK PANEL

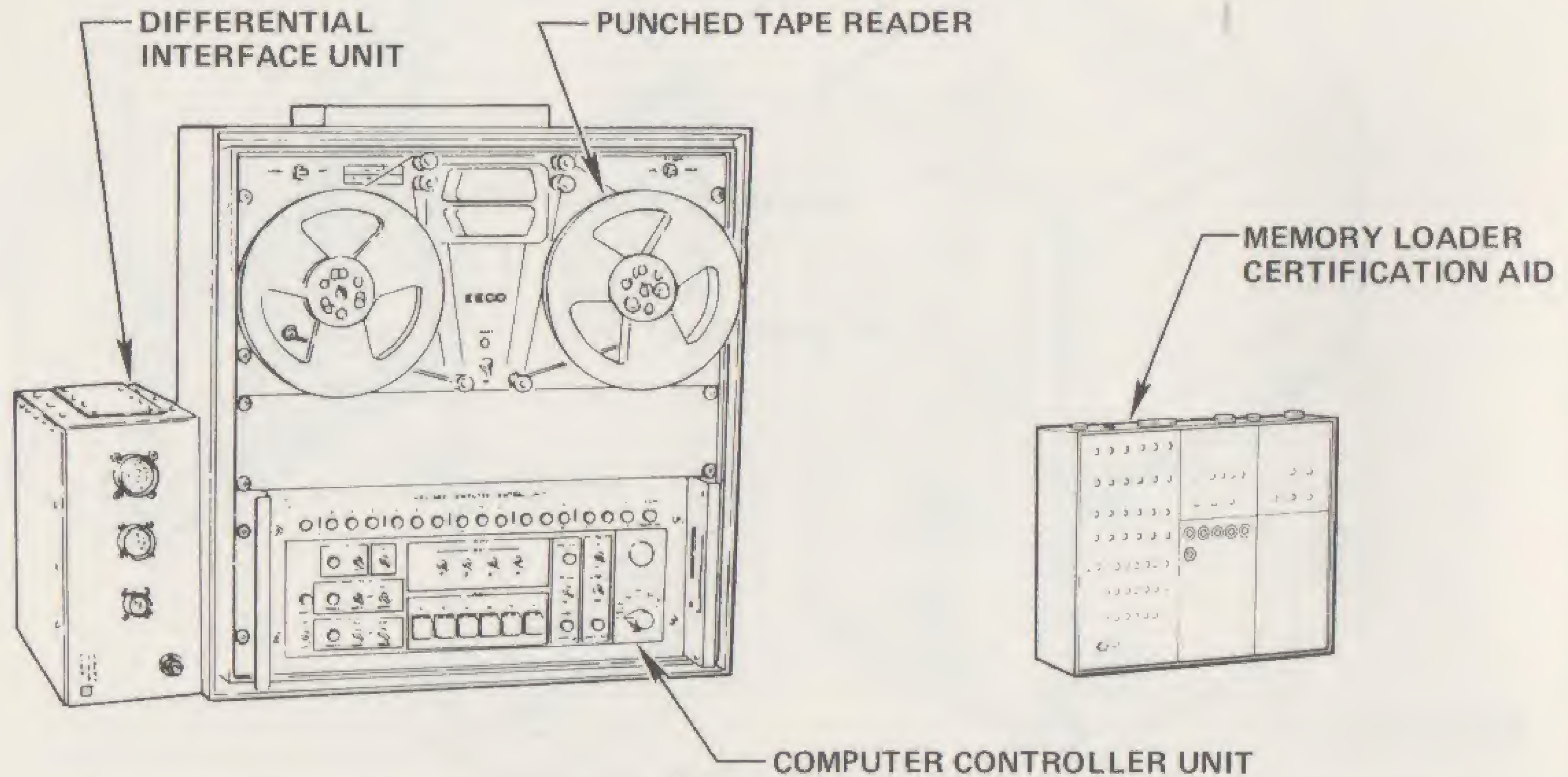
CASE ASSEMBLY



HOSE ASSEMBLY

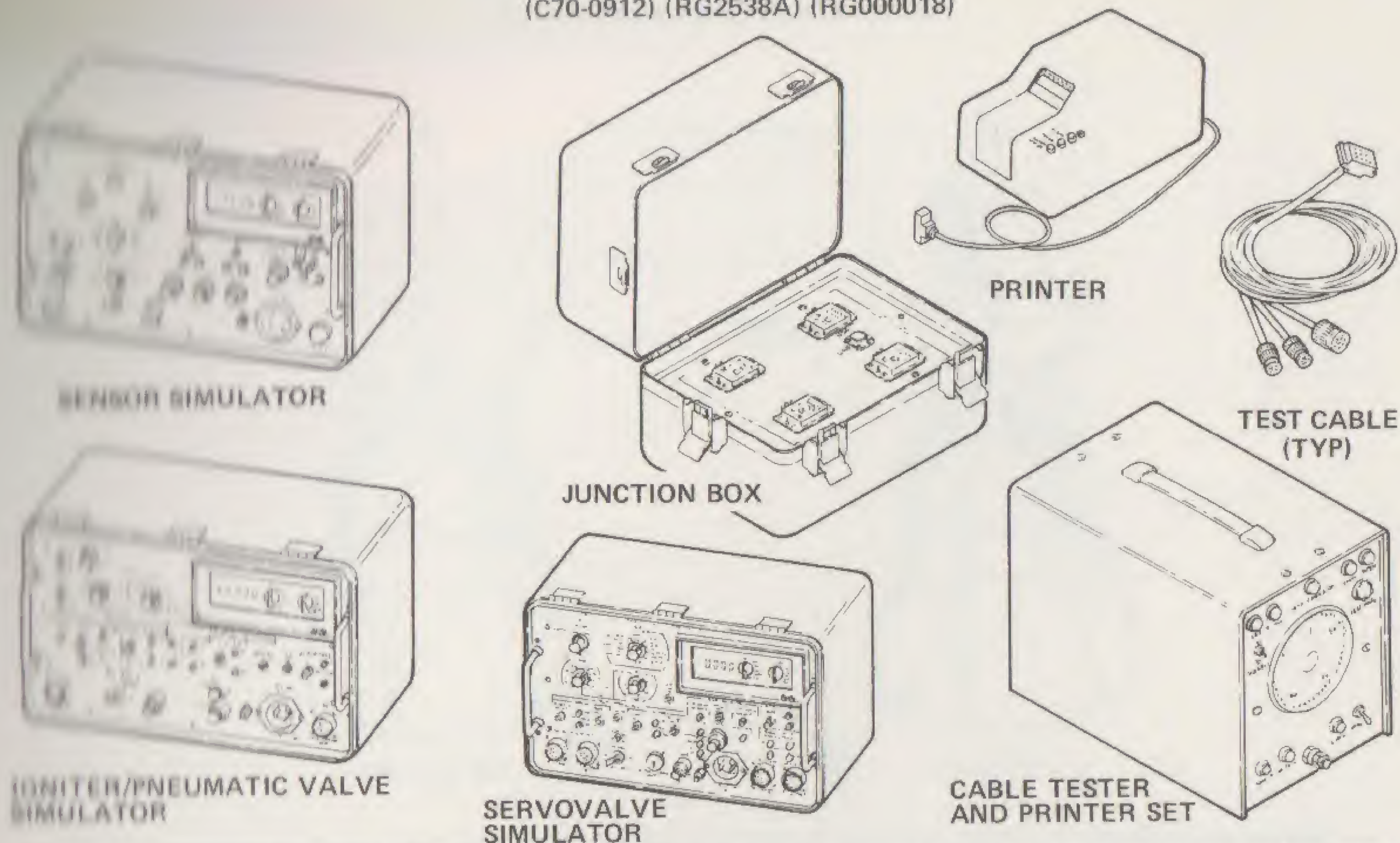
PURPOSE: MEASURE PNEUMATIC LEAKAGE PAST SSME ANTIFLOOD VALVE SEAT (IN-LINE SYSTEM FLOWMETER).

FIGURE 4-7. HIGH-PRESSURE PNEUMATIC FLOW TESTER



PURPOSE: PROVIDE A CAPABILITY TO LOAD AND READ MEMORY AND REGISTERS OF MAIN ENGINE CONTROLLER.

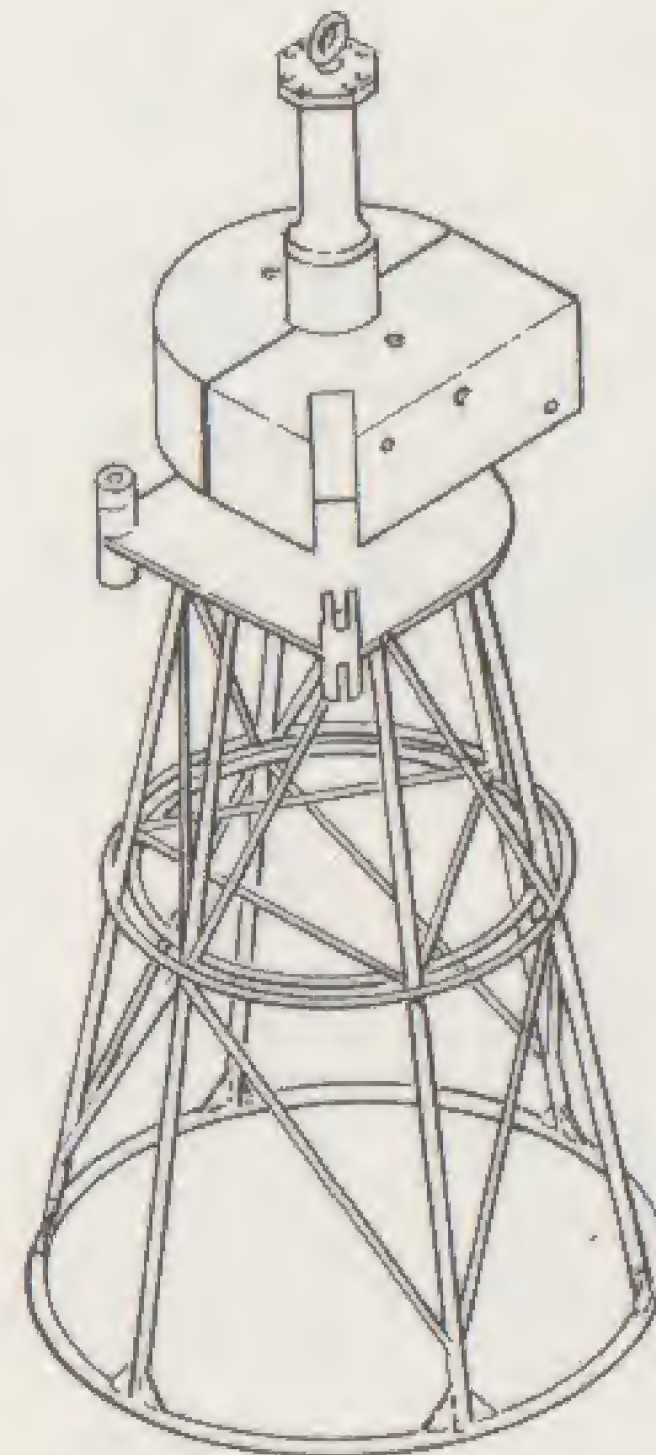
(C70-0912) (RG2538A) (RG000018)



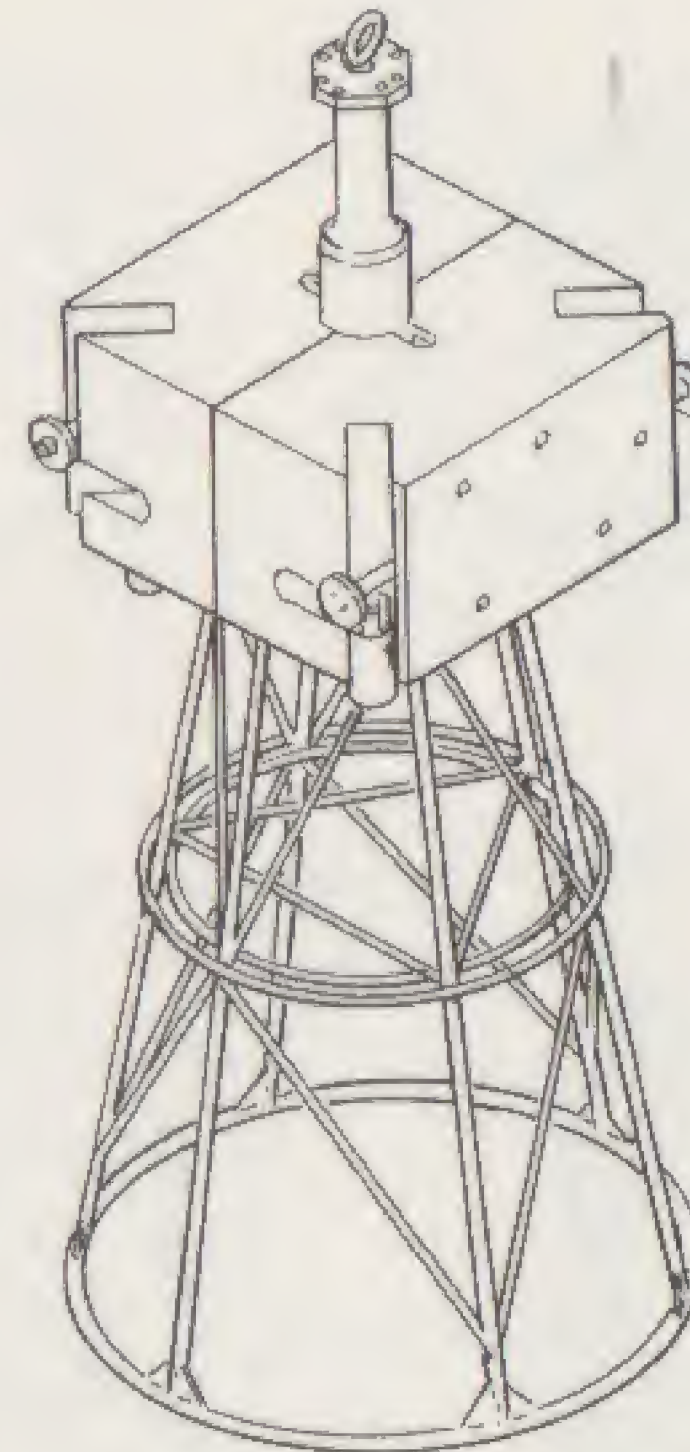
PURPOSE: TROUBLESHOOT SERVOVALVES, SENSORS, IGNITERS, PNEUMATIC VALVES, AND CHECK ELECTRICAL HARNESS FOR CONTINUITY AND INSULATION BREAKDOWN.

FIGURE 4-9. ELECTRICAL CHECKOUT AND MAINTENANCE SET

(S70-0911) (RG2581A) (RG003010)



1G WEIGHT

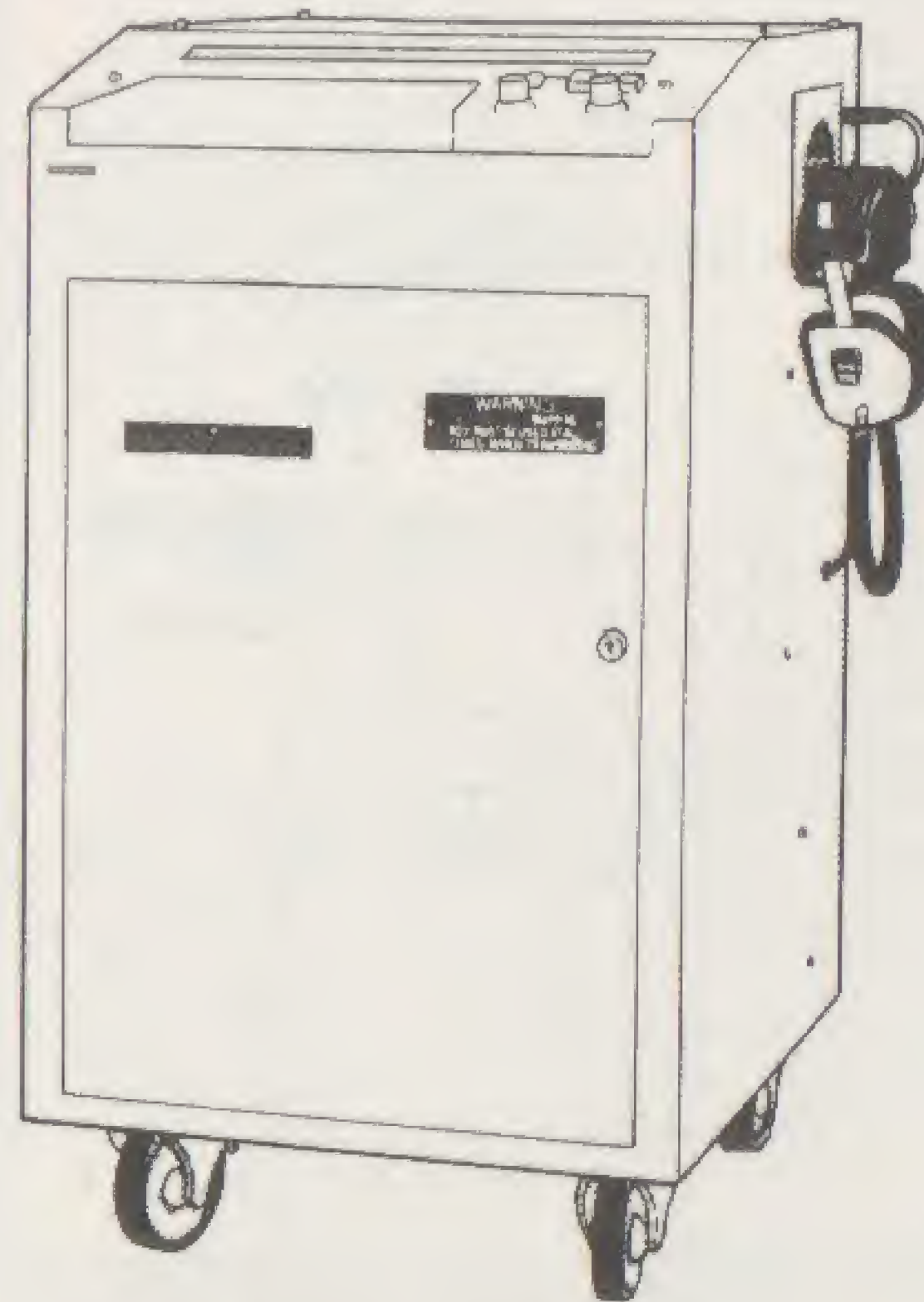


3G WEIGHT

PURPOSE: REPRESENTS SSME ENVELOPE; CONFIGURED TO 3G WEIGHT FOR PROOF TEST;
CONFIGURED TO 1G WEIGHT FOR CRITICAL LIFTS; USED TO VALIDATE EQUIPMENT
AND PERSONNEL.

FIGURE 4-10. ENGINE SIMULATOR WEIGHT

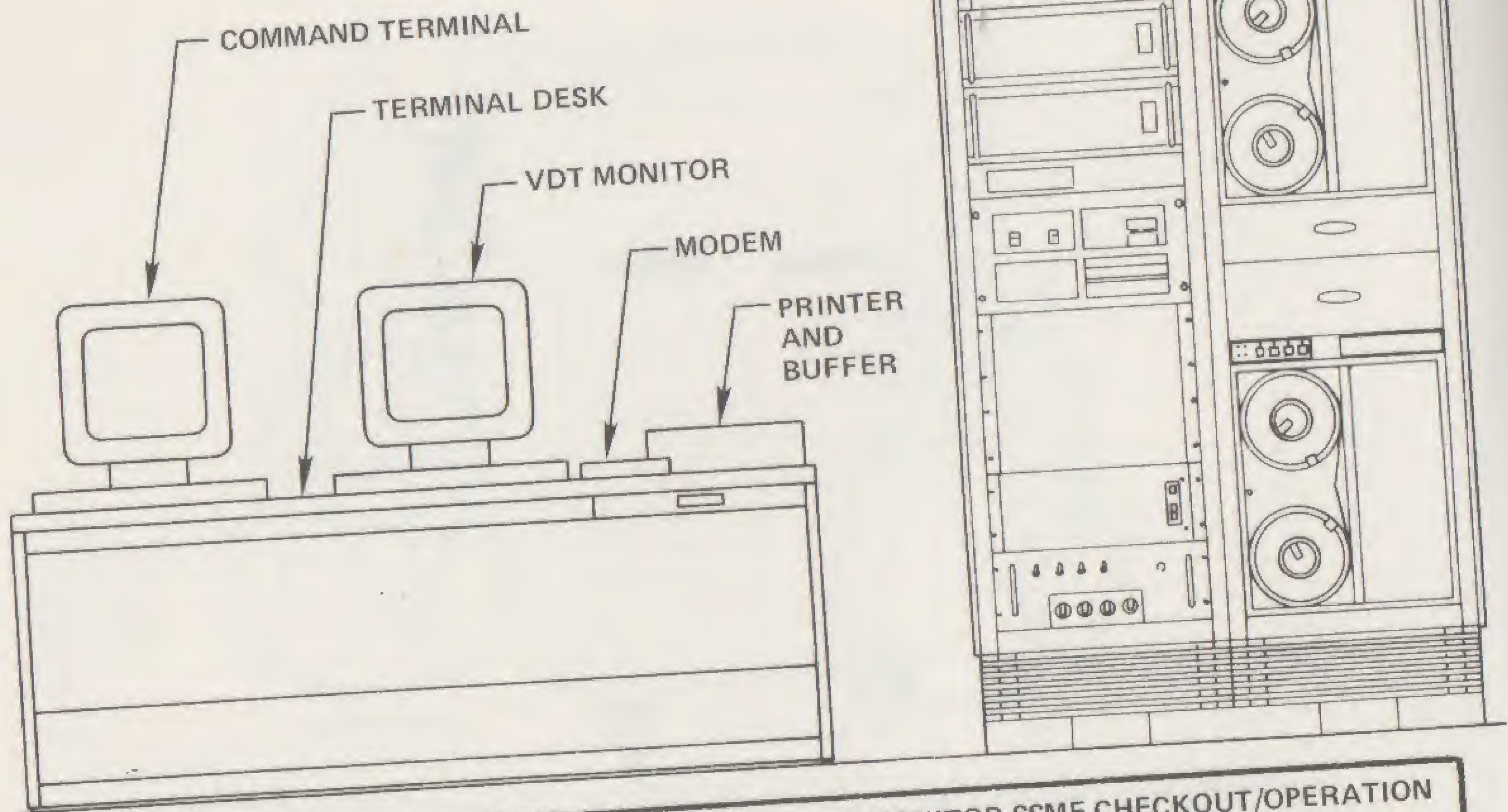
(C70-0917) (RG2577A) (RG000480)



PURPOSE: PROVIDE FAST, SENSITIVE MONITOR OF GASES DURING STATIC BAG AND VIOLATED JOINT LEAK CHECKS.

FIGURE 4-11. MULTIPLE GAS ANALYZER ASSEMBLY

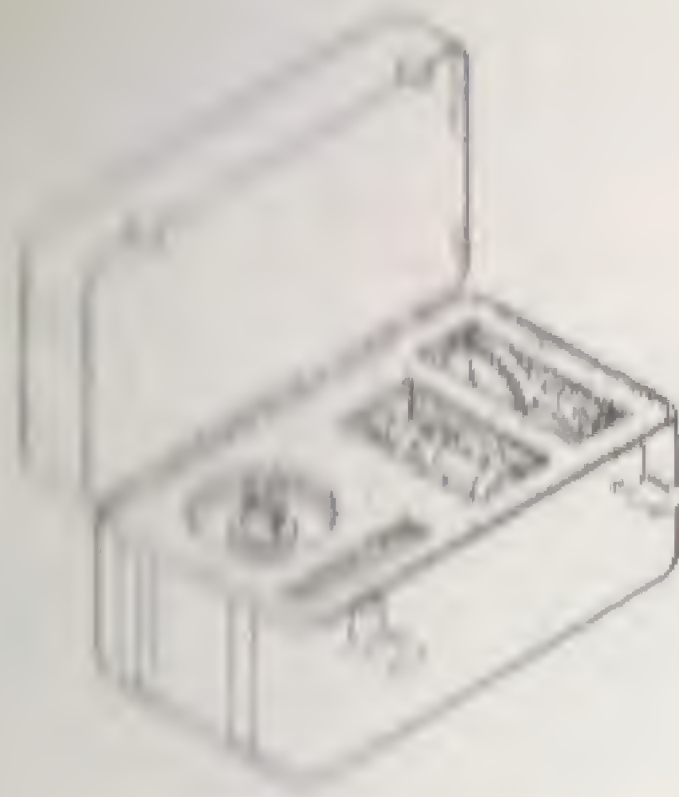
(C70-0906) (RG2550A) (RG000521)
FRONT VIEW



PURPOSE: PROVIDE A CAPABILITY TO PERFORM AND MONITOR SSME CHECKOUT/OPERATION
IN SSME SHOP.

FIGURE 4-12. COMMAND AND DATA SIMULATOR

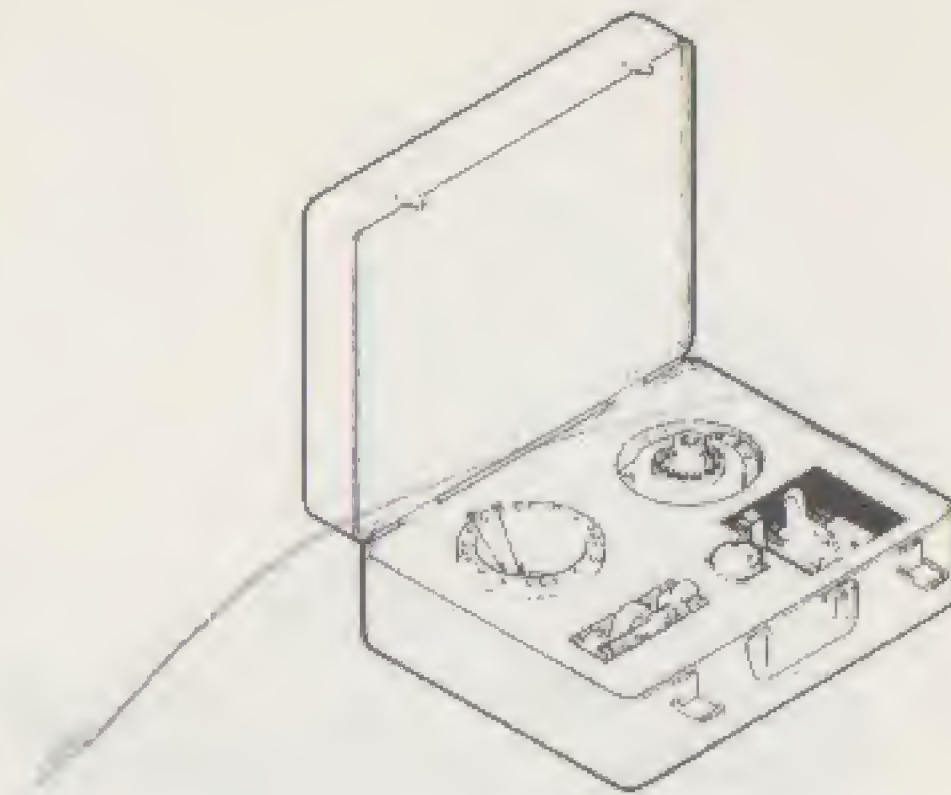
(C70-0907) (RG2575A) (RG000020)



LPOTP SHAFT
TRAVEL SET



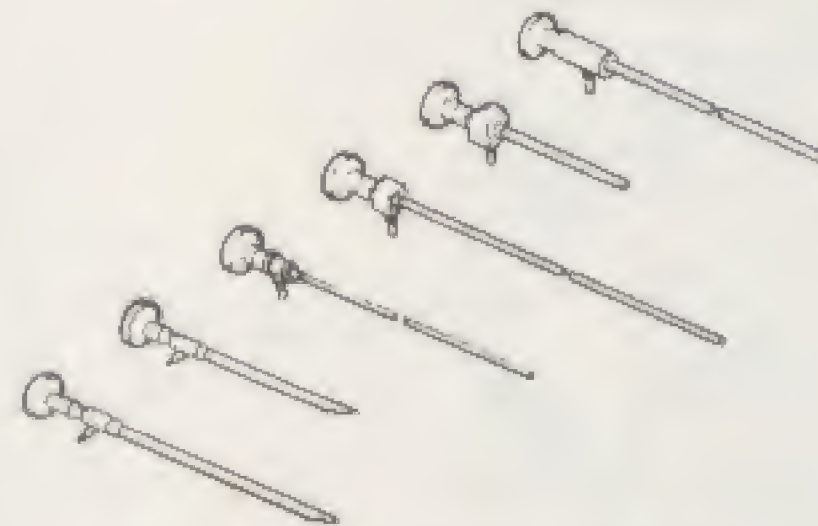
CROWFOOT WRENCH
SET



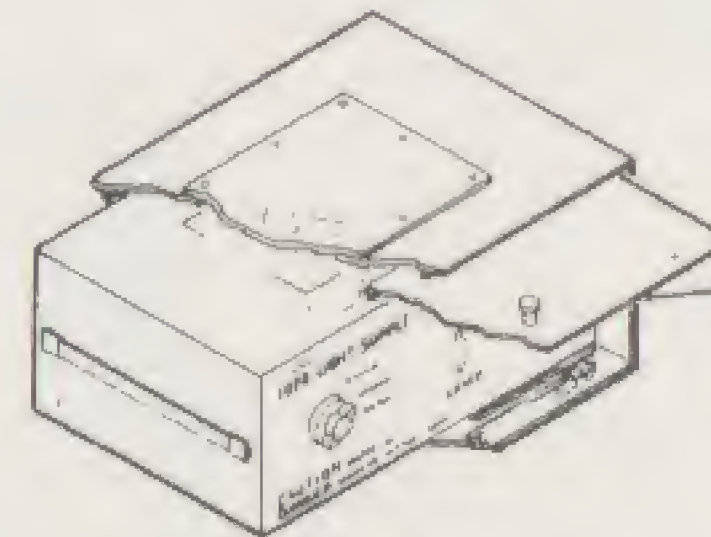
HPFTP TORQUE
TOOL SET



FLEXIBLE BORESCOPE
(TYP)



RIGID BORESCOPIES



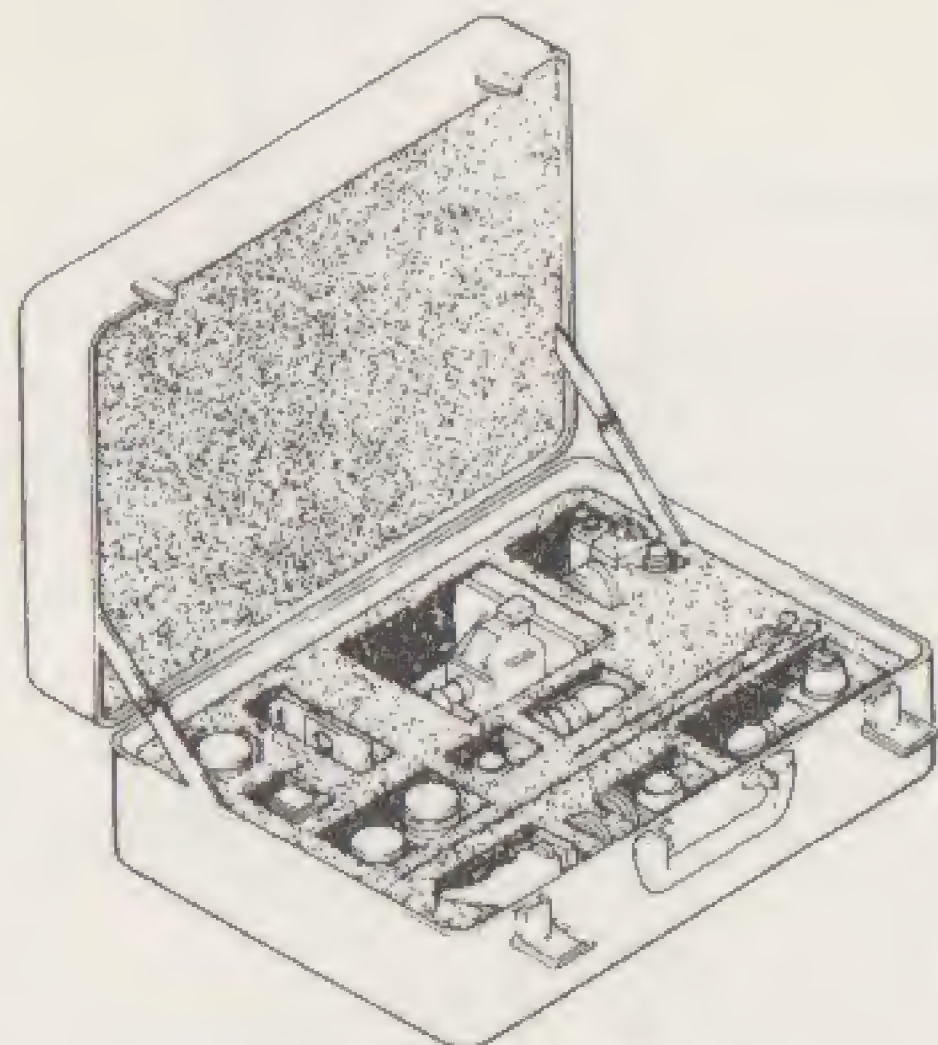
LIGHT SUPPLY



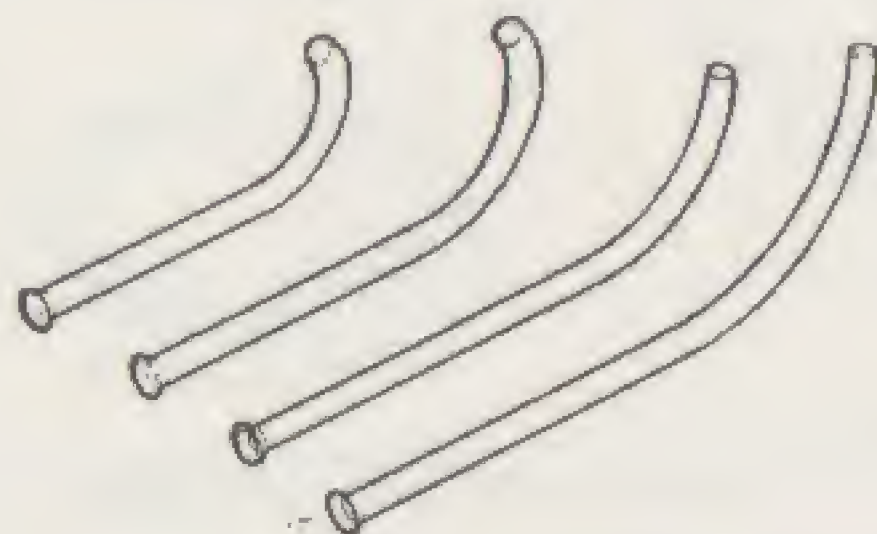
LIGHT CARRIERS

PURPOSE: PROVIDE ABILITY TO VISUALLY INSPECT AND RECORD RESULTS OF OTHERWISE INACCESSIBLE AREAS OF ENGINE AND CONDUCT TORQUE CHECKS OF TURBOPUMPS.

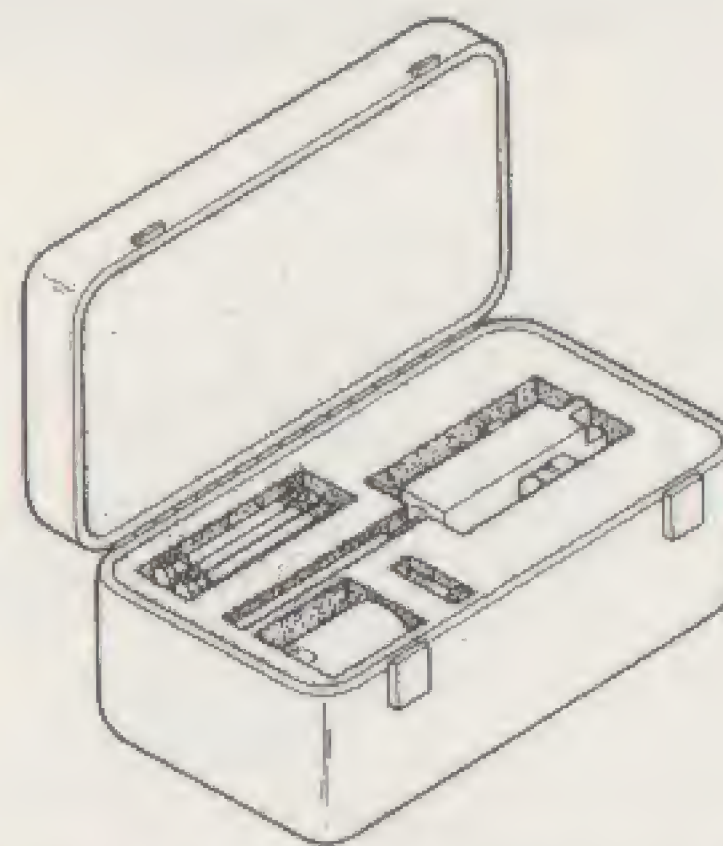
FIGURE 4-13. INTERNAL INSPECTION SET (SHEET 1 OF 3)



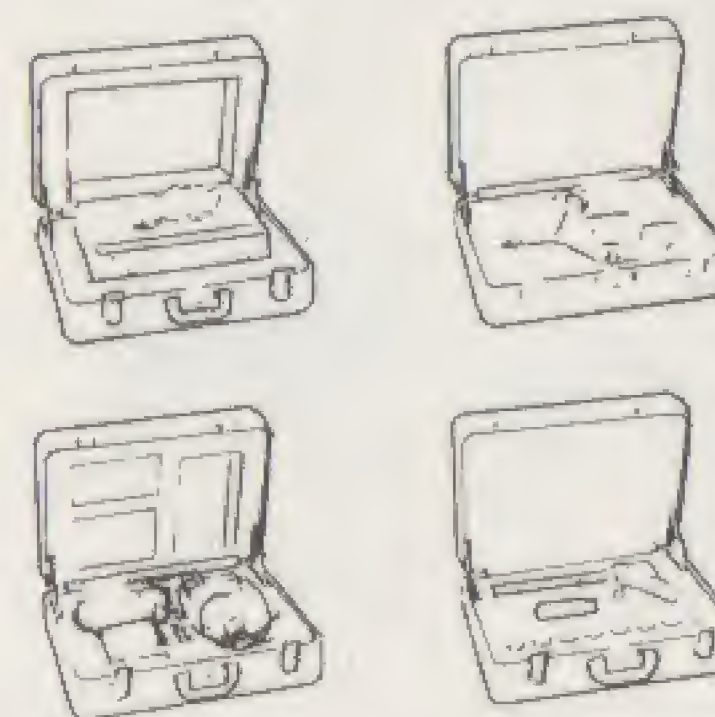
CAMERA SET



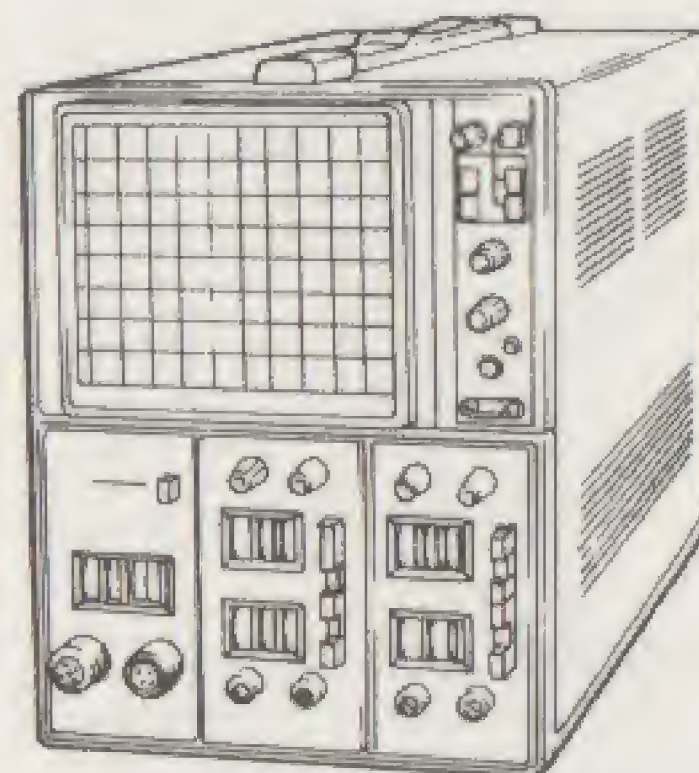
**POSITIONING
ADAPTER SET**



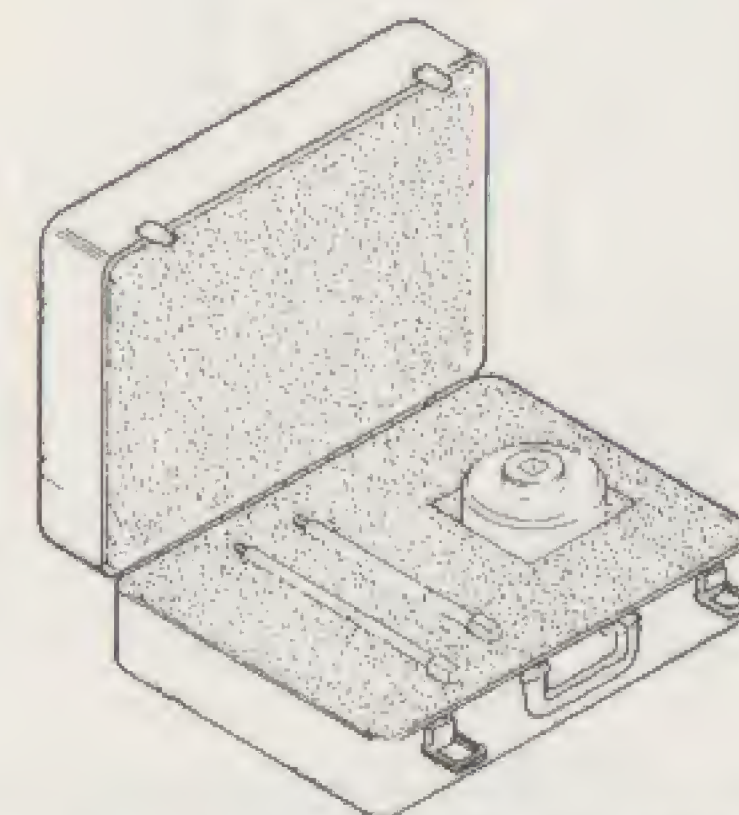
HPOTP SHAFT TRAVEL SET



MICROSCOPE SET

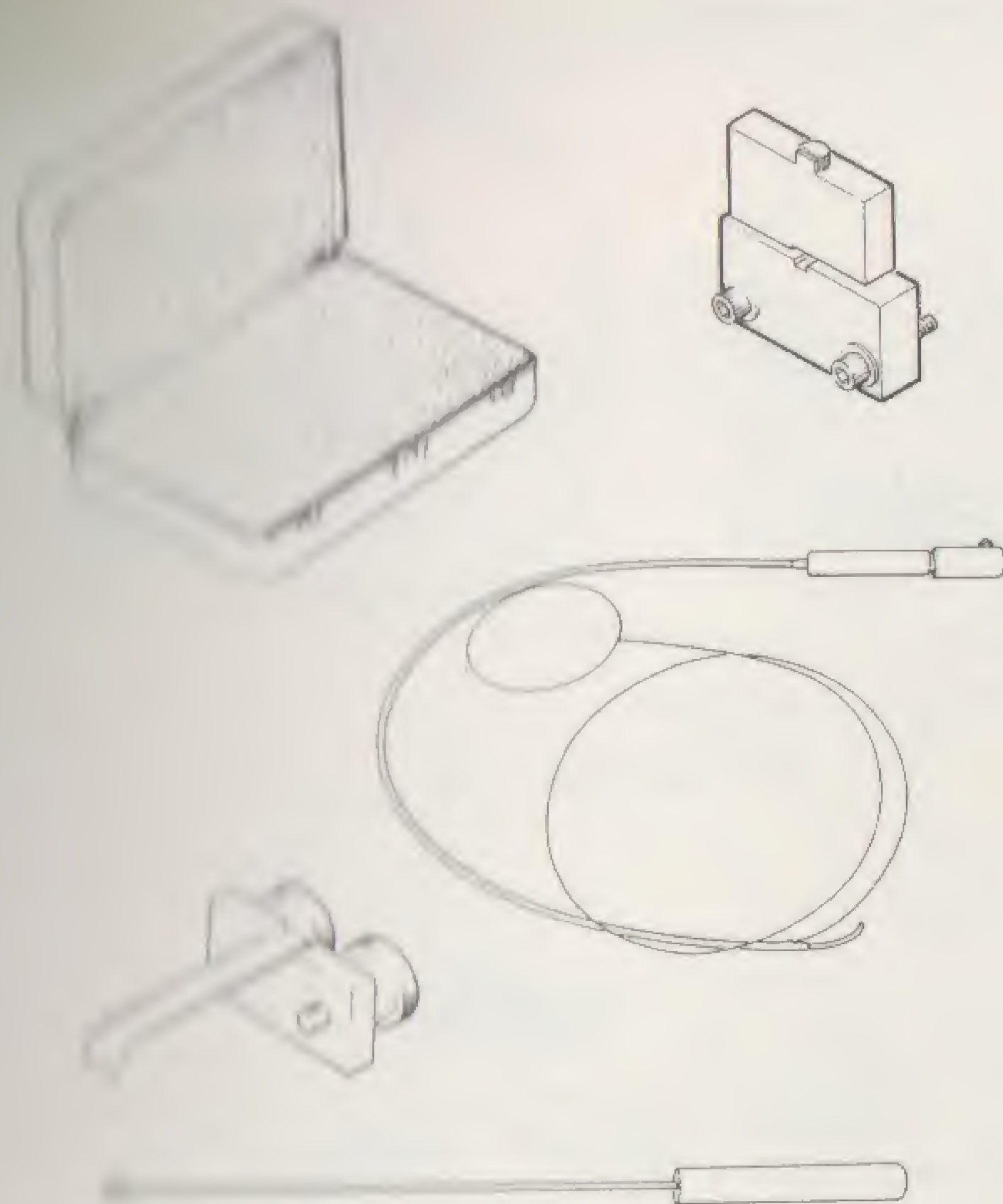


**COMPONENT EDDY
CURRENT MEASUREMENT SET**

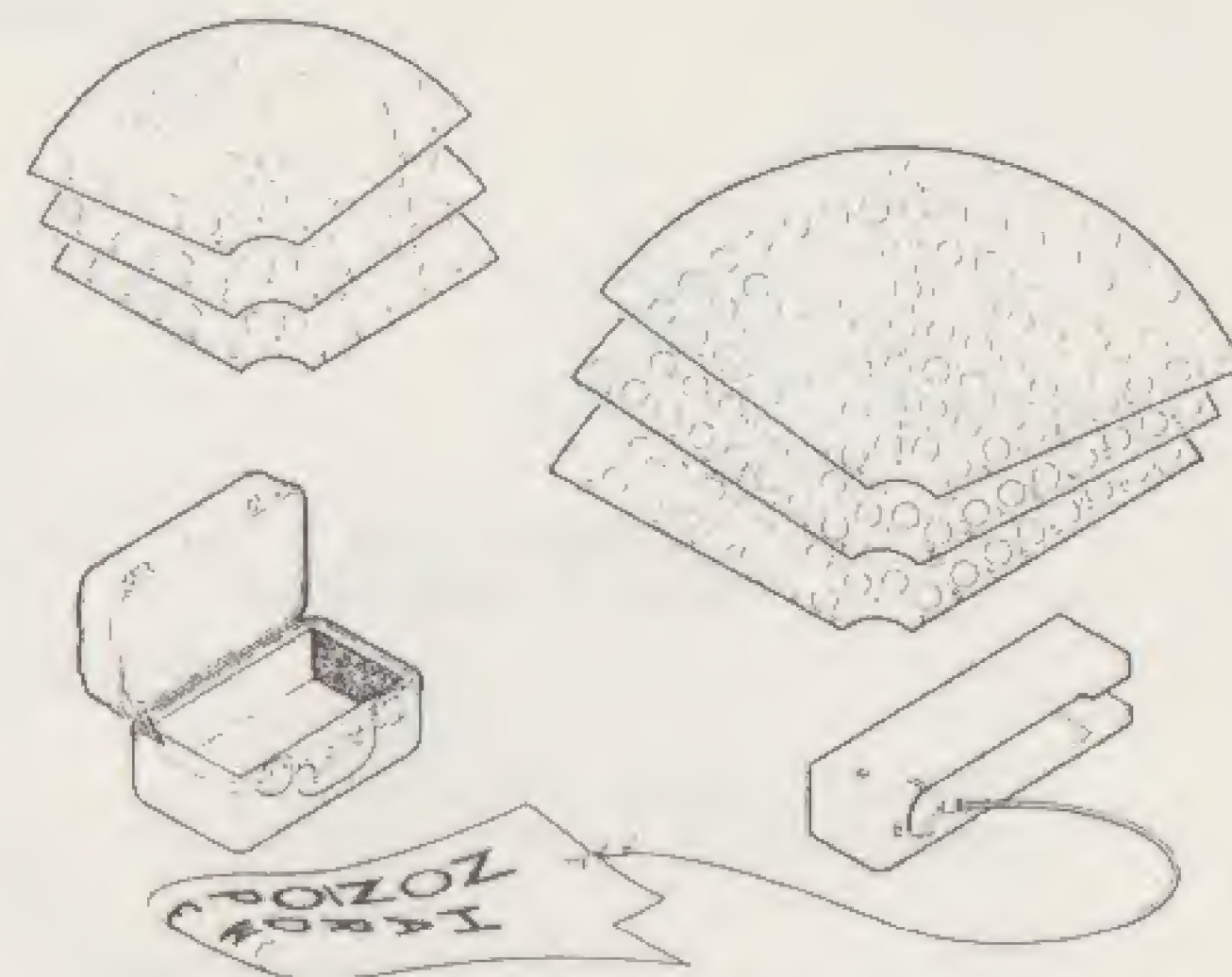


**TURBOPUMP ROTATING
TOOL SET**

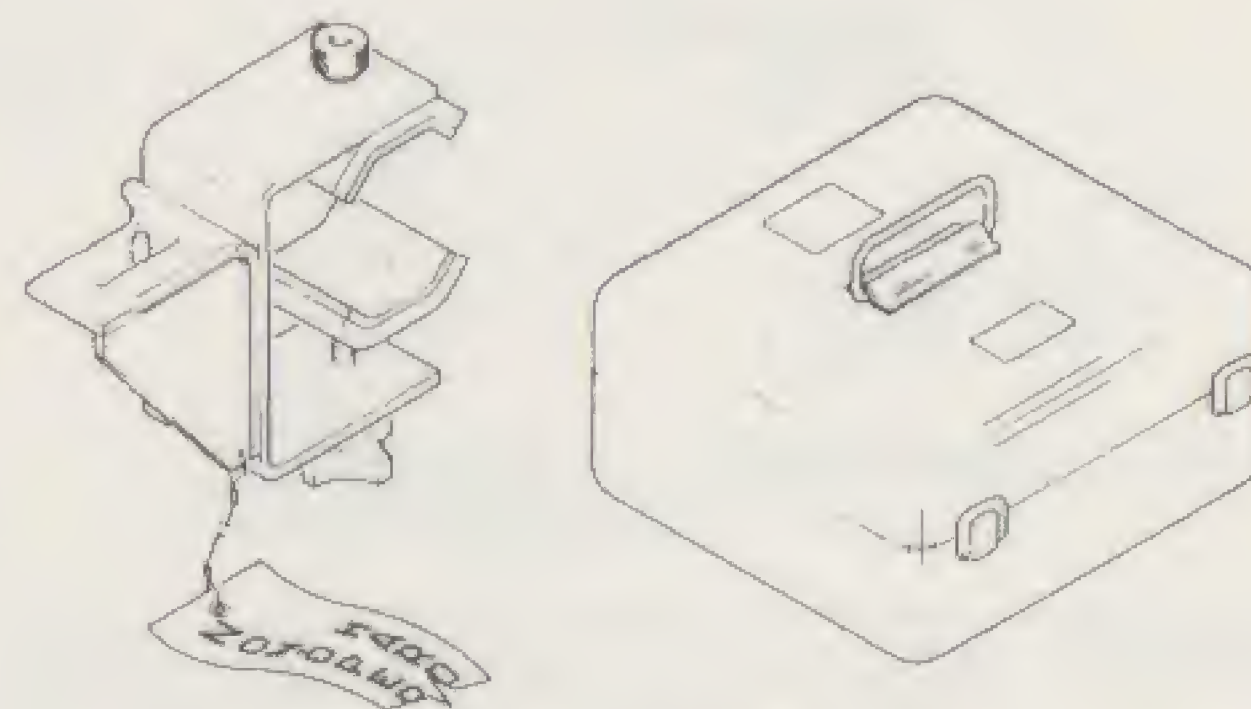
FIGURE 4-13. INTERNAL INSPECTION SET (SHEET 2 OF 3)



GUIDE TUBE SET

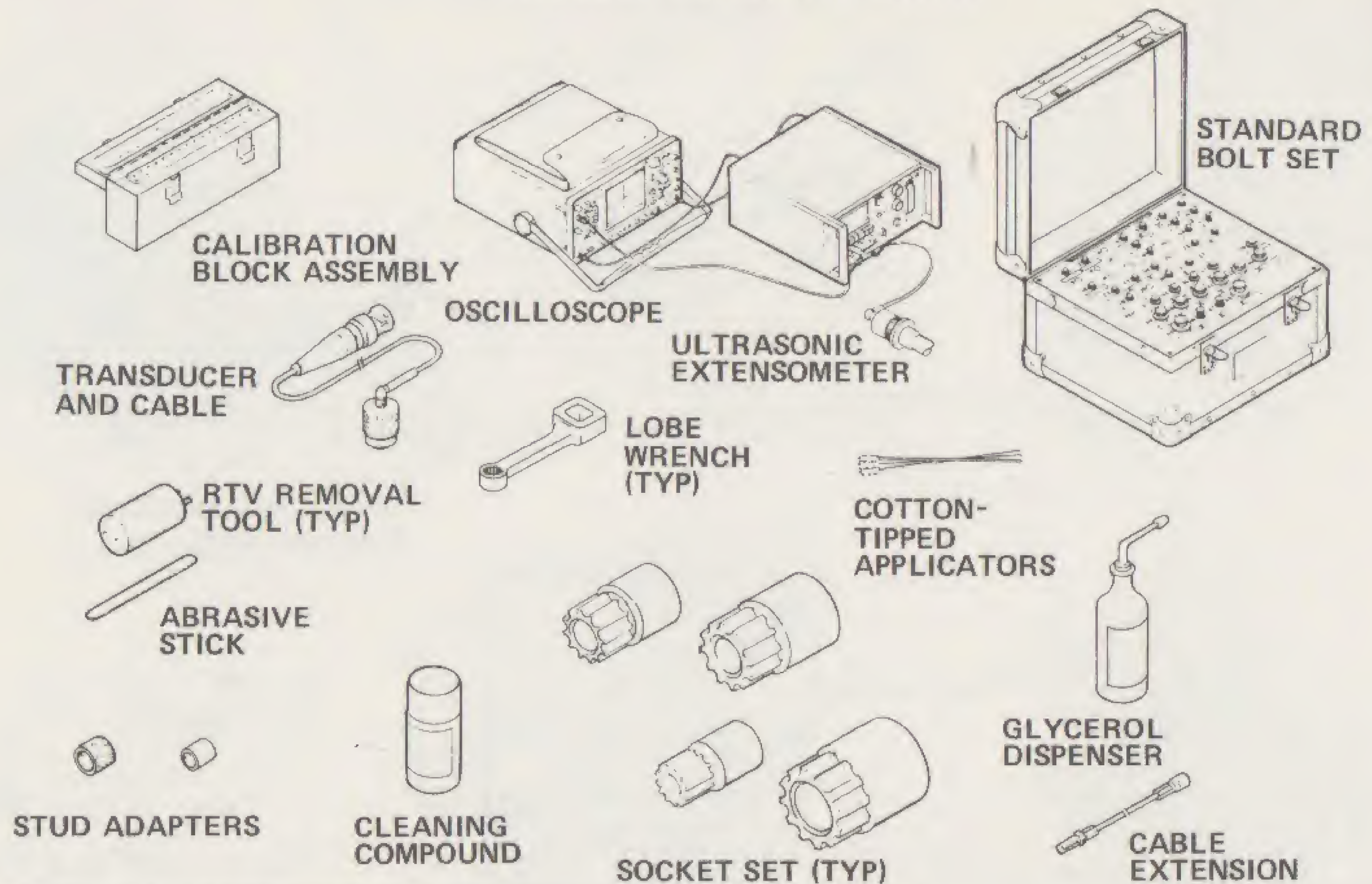


PREBURNER INJECTOR
ELEMENT SET



CAMERA MOUNT SET

FIGURE 4-13. INTERNAL INSPECTION SET (SHEET 3 OF 3)



PURPOSE: PRELOAD (STRETCH) BOLTS AND STUDS; ALINE PROPELLANT VALVE ACTUATOR TO VALVE BODY; AND FACILITATE REPLACEMENT OF VARIOUS LRUs.

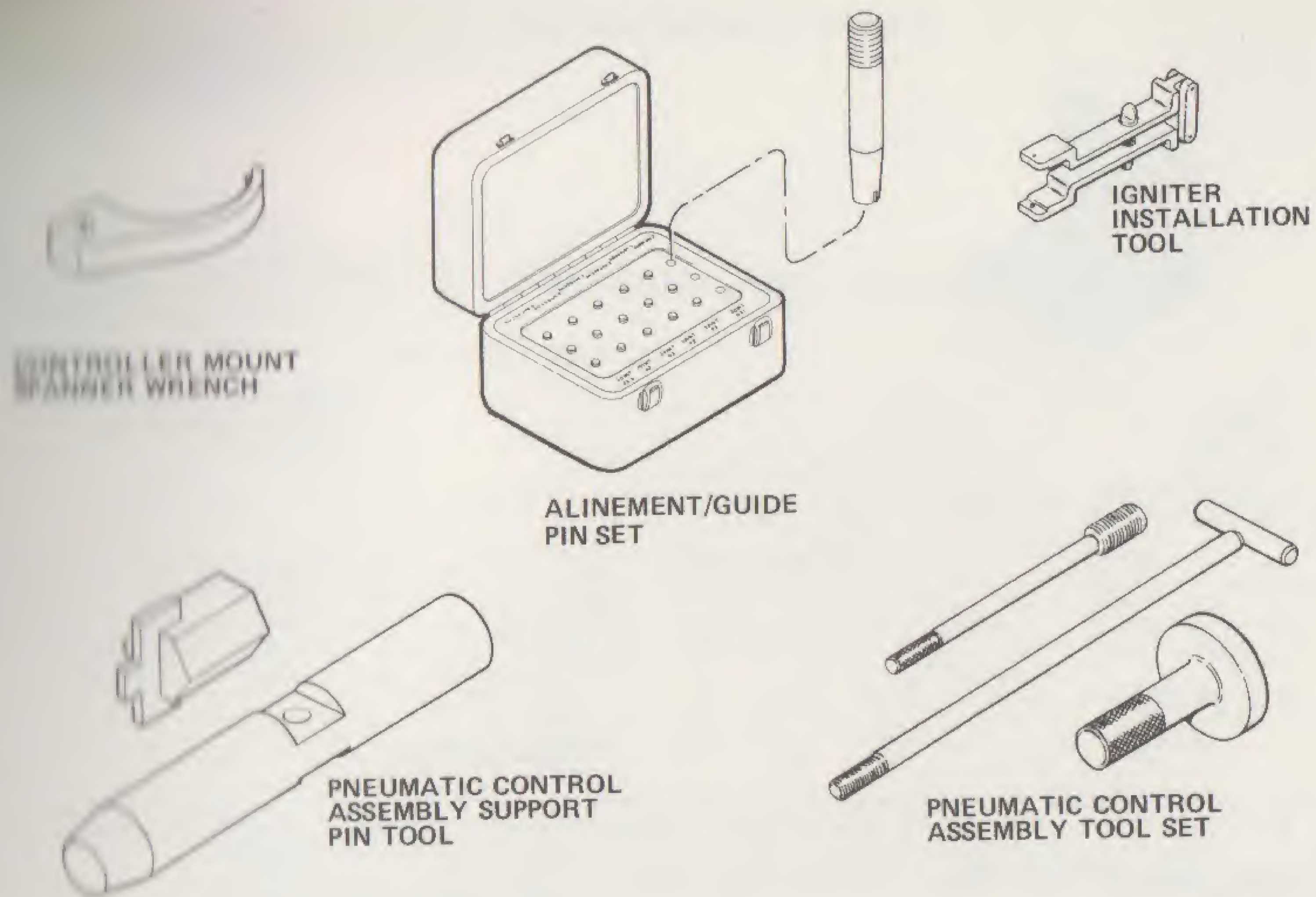
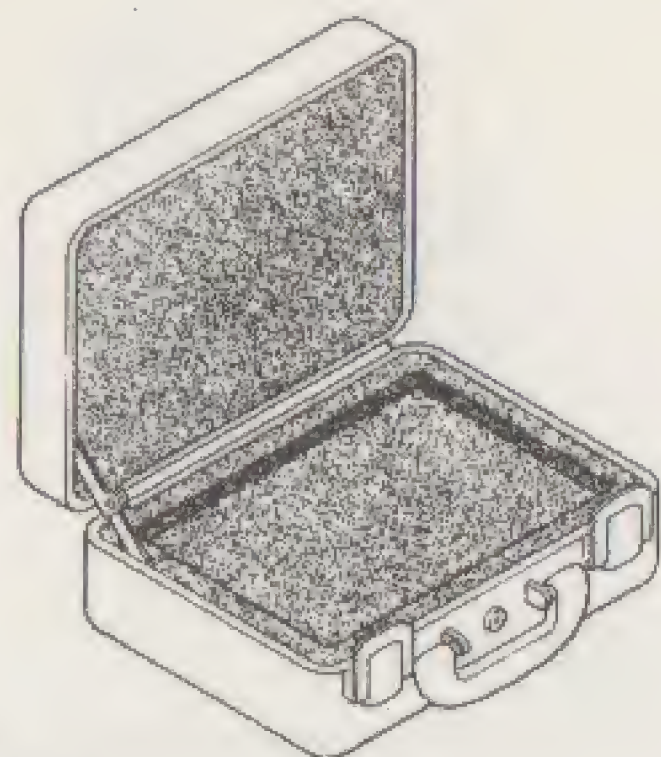
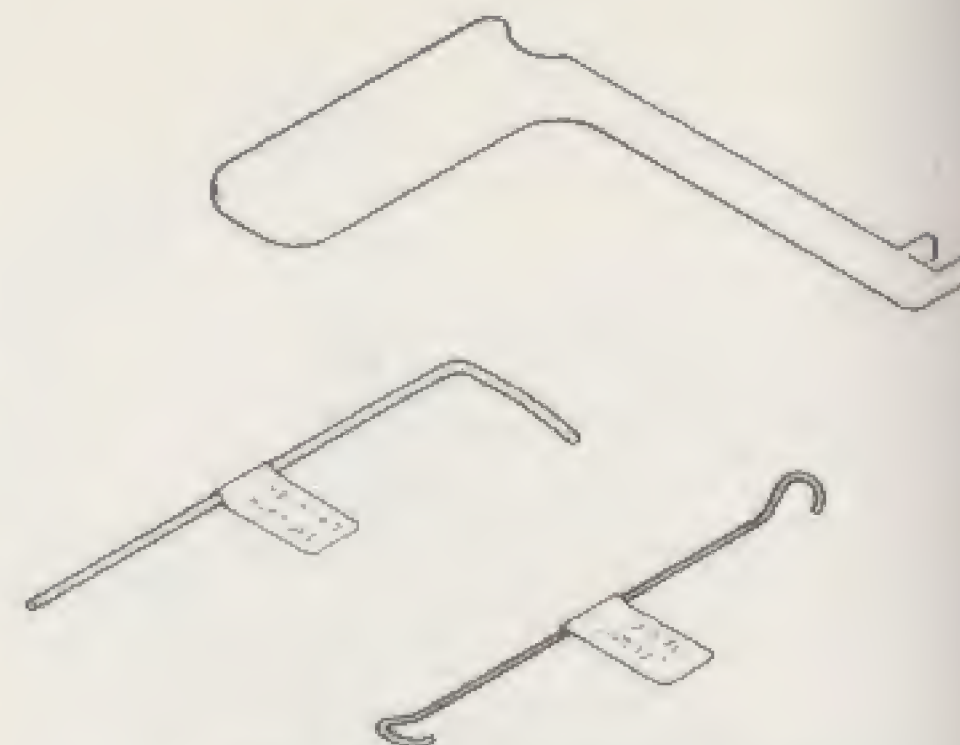


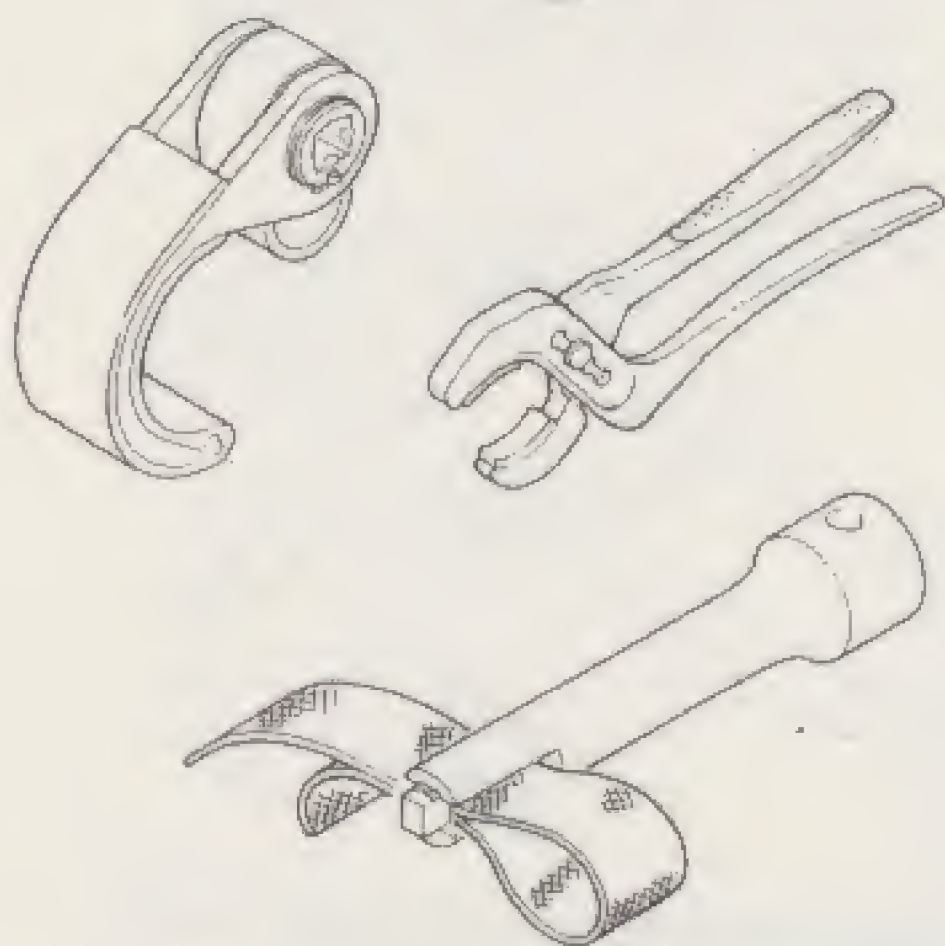
FIGURE 4-14. SPECIAL TOOL SET (SHEET 2 OF 3)



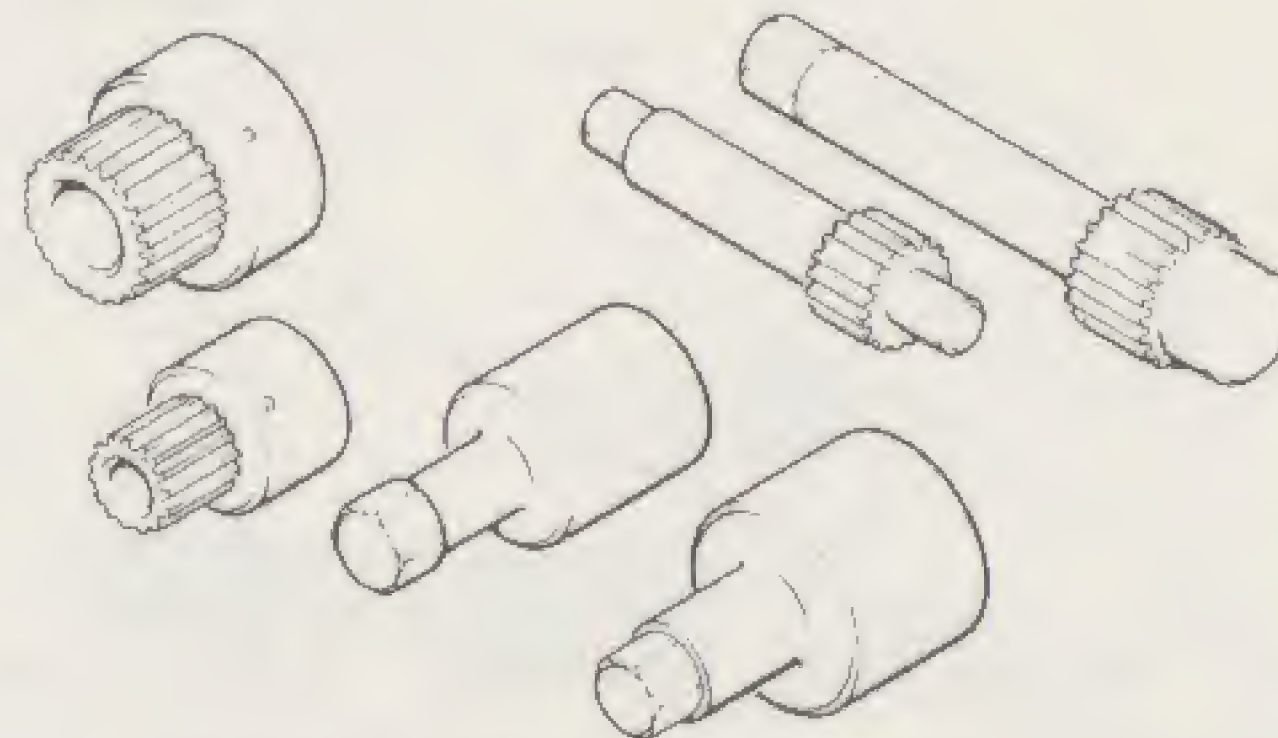
SEAL HOLDING TOOL



HEAT EXCHANGER COIL
TUBING INSPECTION
TOOL SET



ELECTRICAL CONNECTOR
WRENCH SETS

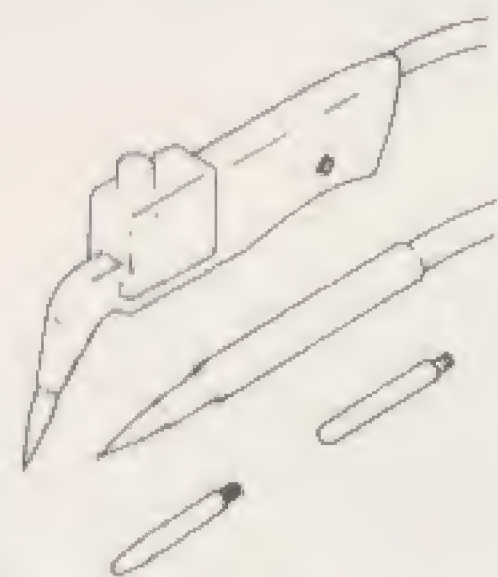


ACTUATOR INSTALLATION
TOOL SET

(S70-0908) (RG2539A) (RG000024)



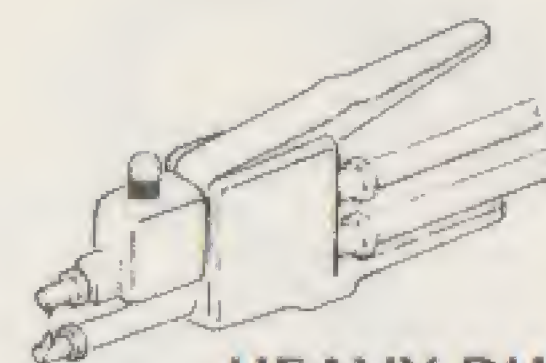
SPOT WELDER



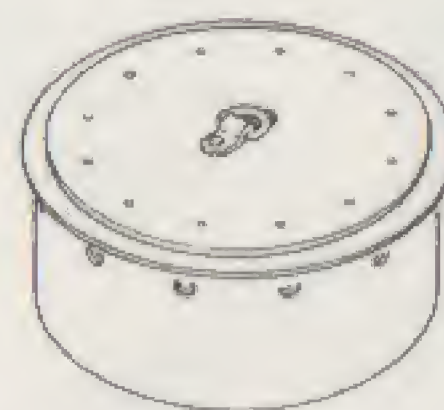
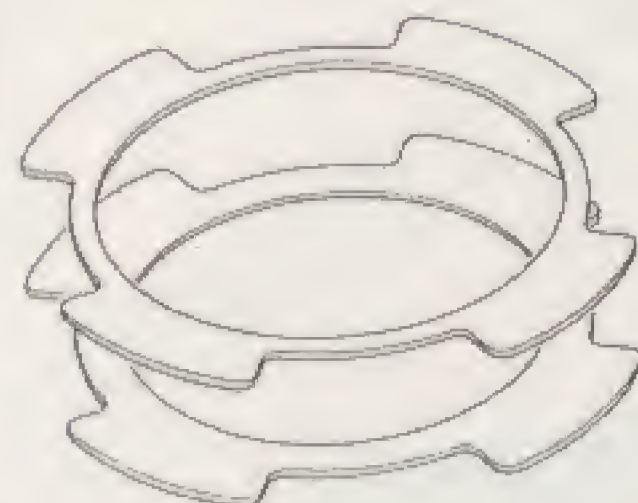
WELDING PROBE



PUSH HAND GUN



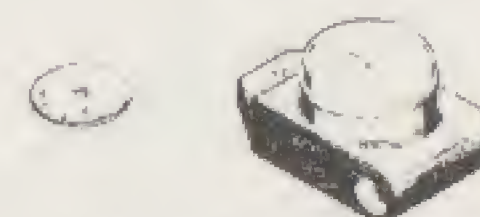
HEAVY-DUTY
TWEezer



HPFTP COVER SET



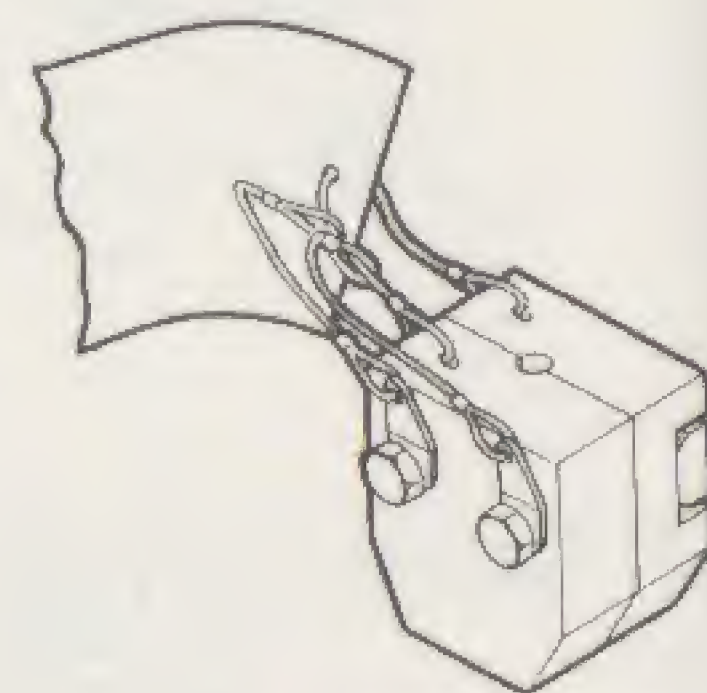
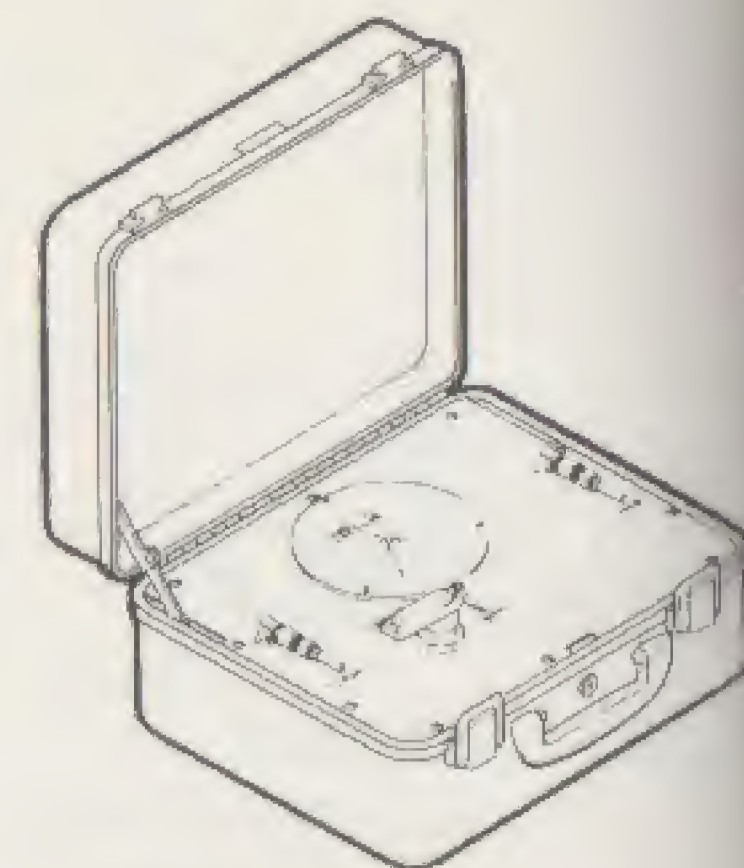
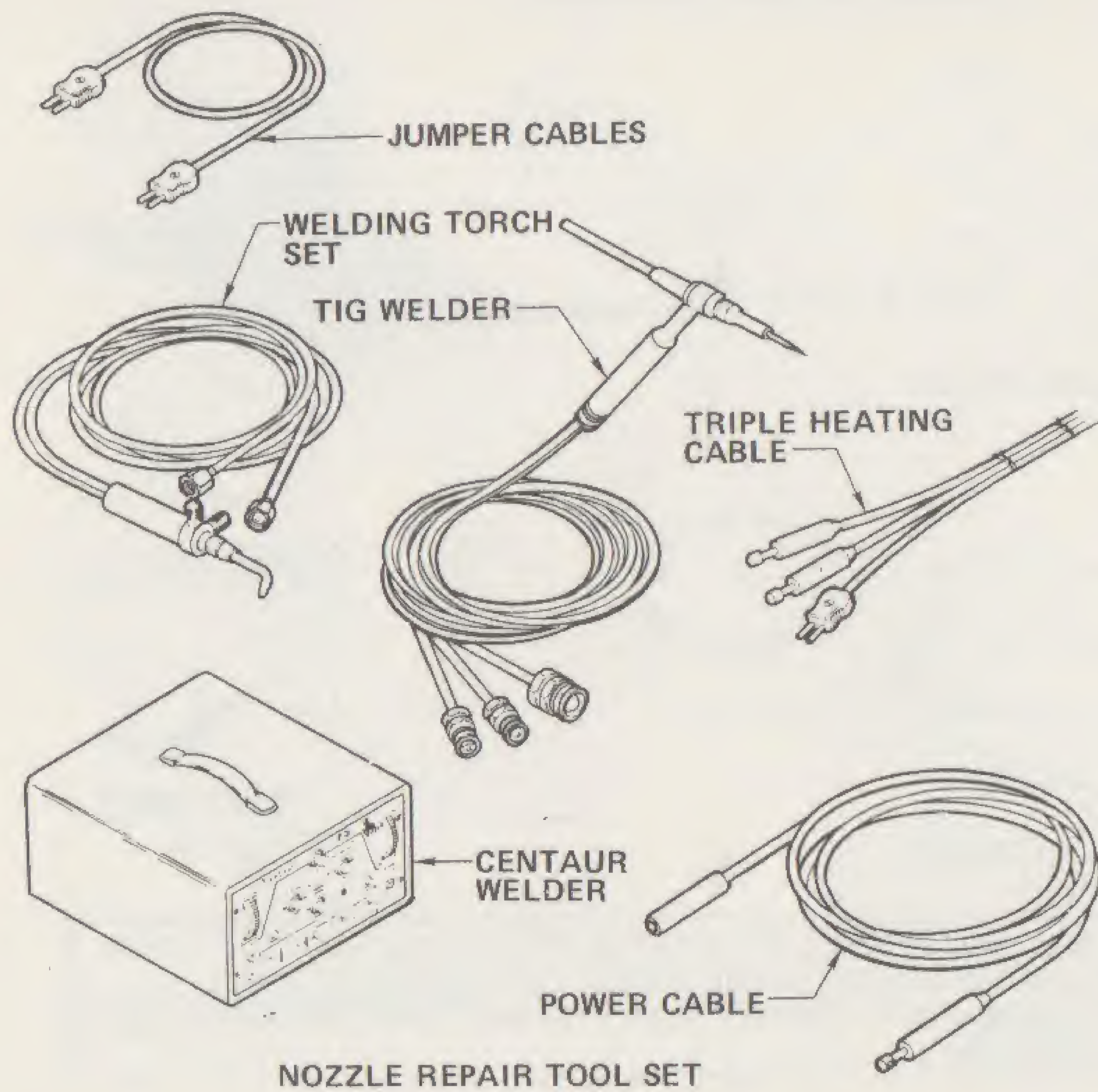
ACCESSORY
CONTAINER (TYP)

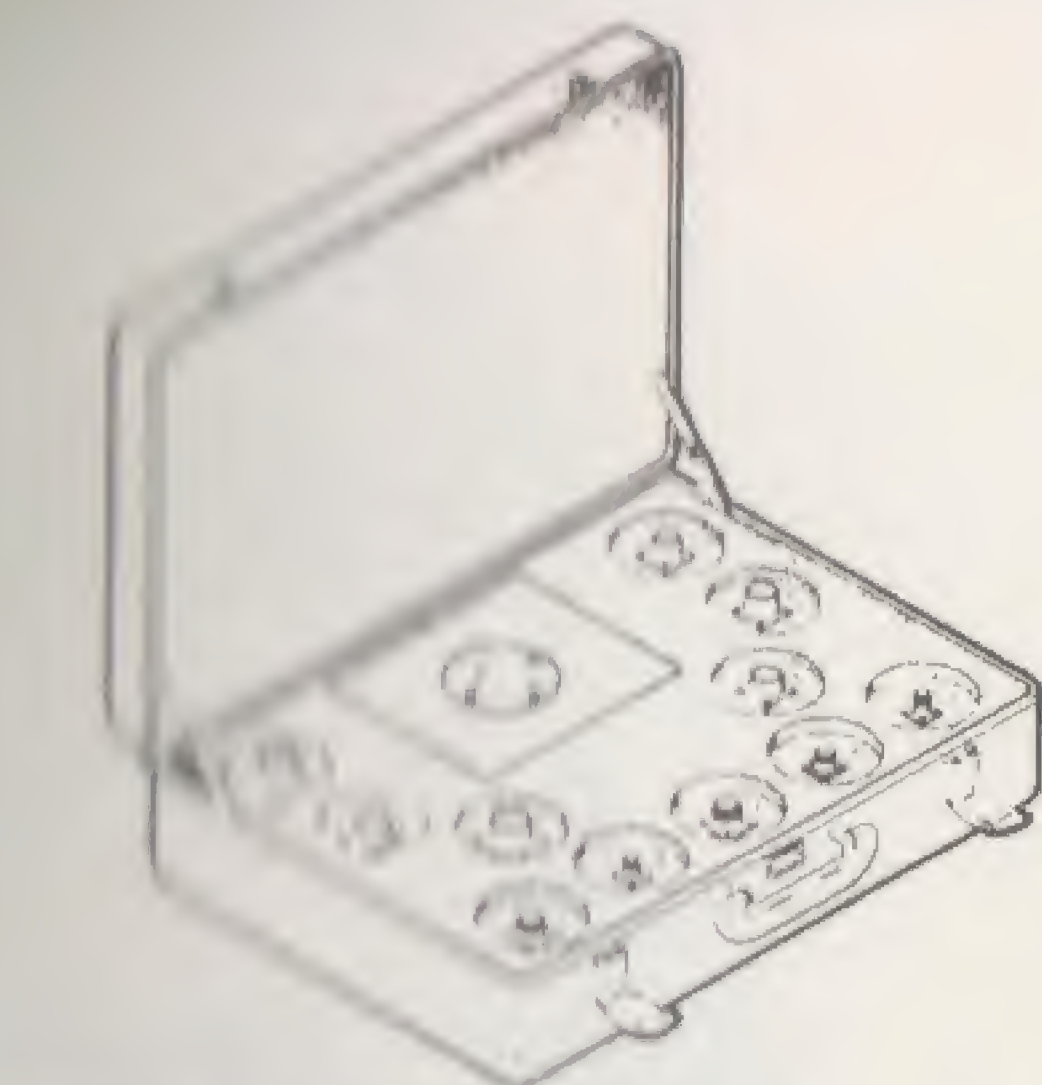


FORCE GAGE

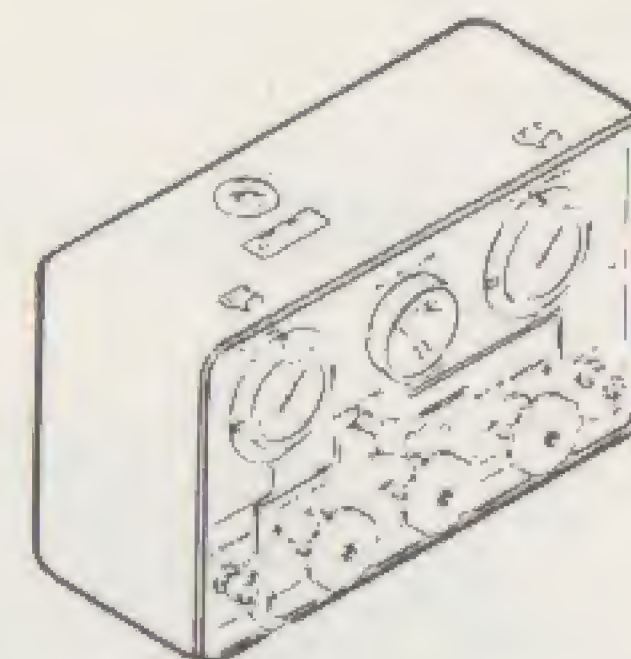
PURPOSE: SPOT-WELD THRUST CHAMBER NOZZLE INSULATION, WELD-REPAIR NOZZLE TUBES; REPRESSURIZE MAIN ENGINE CONTROLLERS; REMOVE HIGH-PRESSURE FUEL TURBOPUMP BELLOWS SHIELD; REPAIR ELECTRICAL CONNECTORS; AND TEST AND REPAIR INJECTOR ELEMENTS.

FIGURE 4-15. MAINTENANCE AND REPAIR SET (SHEET 1 OF 3)

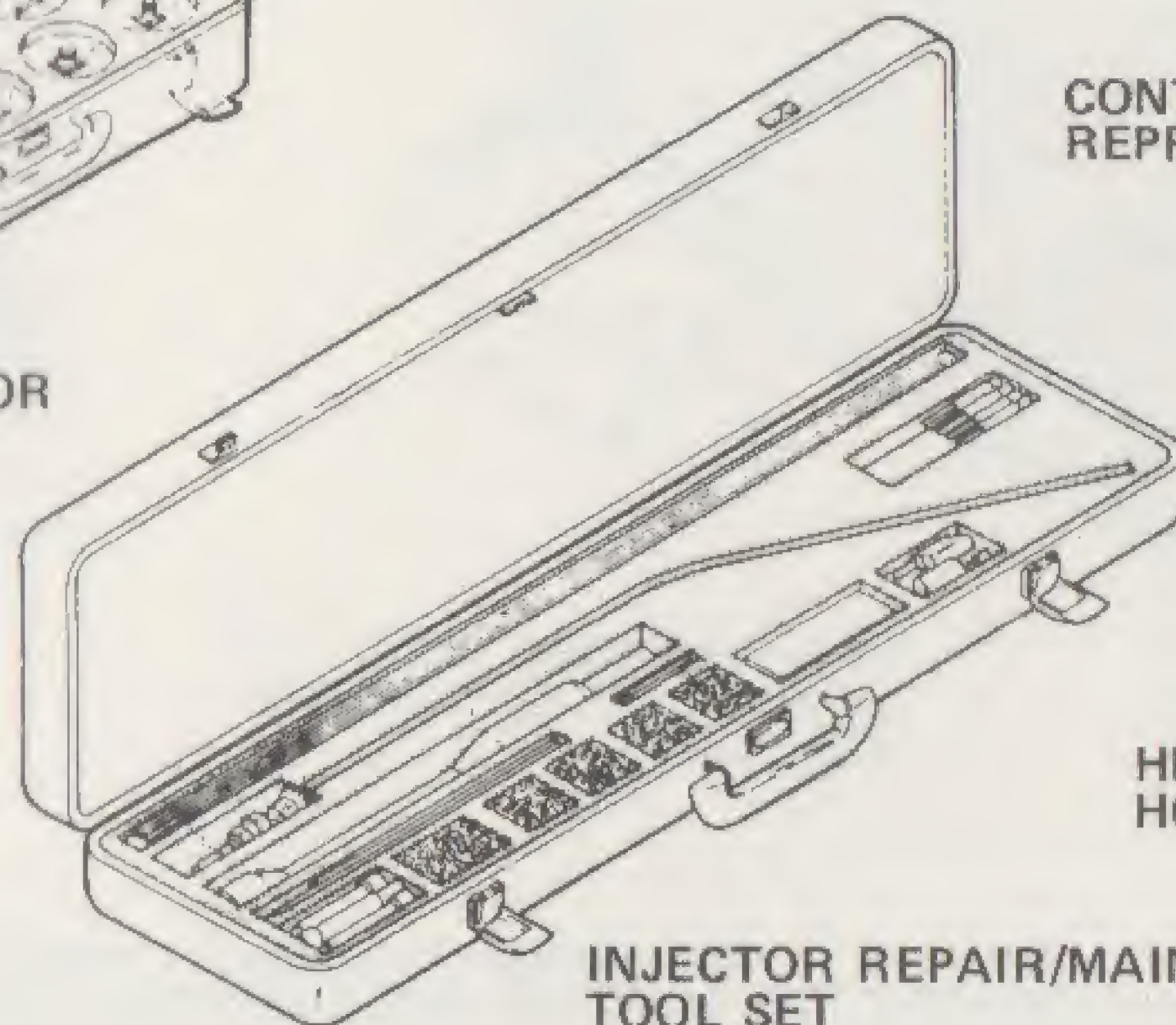




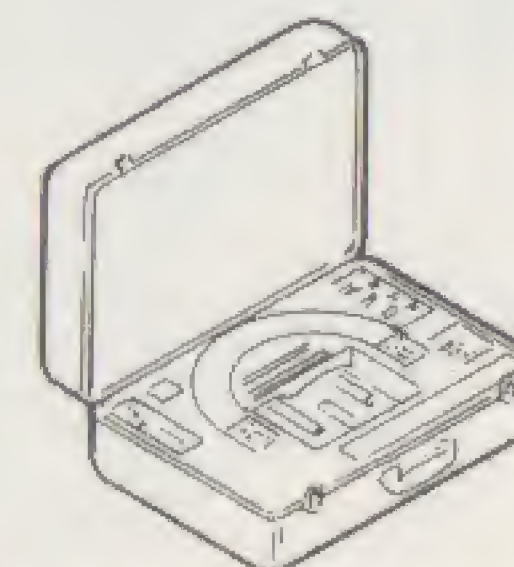
ELECTRICAL CONNECTOR
TORQUING TOOL SET



CONTROLLER
REPRESSURIZATION SET

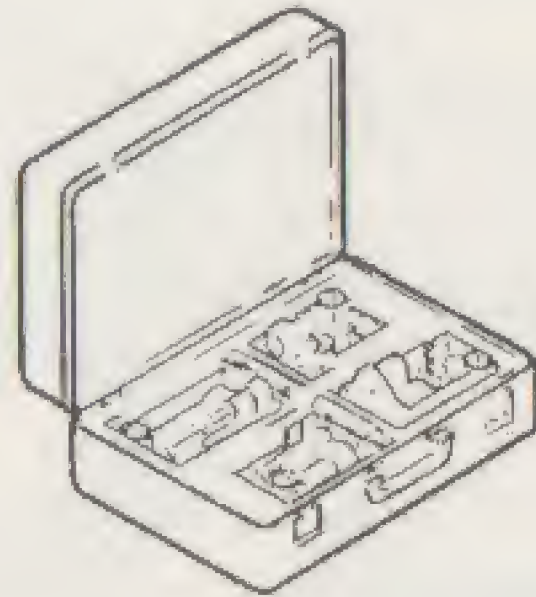


INJECTOR REPAIR/MAINTENANCE
TOOL SET

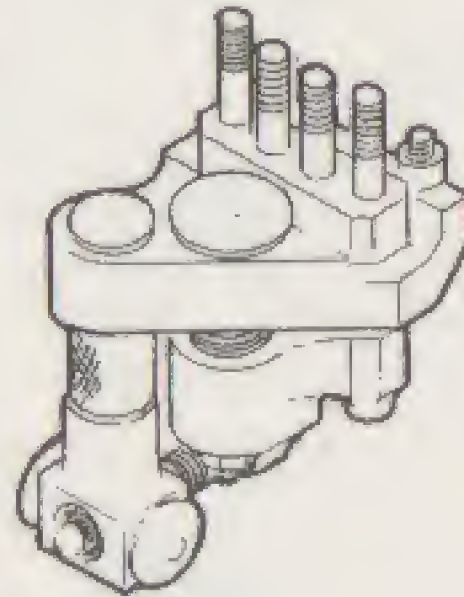


HPFTP BELLOWS SHIELD AND
HOUSING STUD TOOL SET

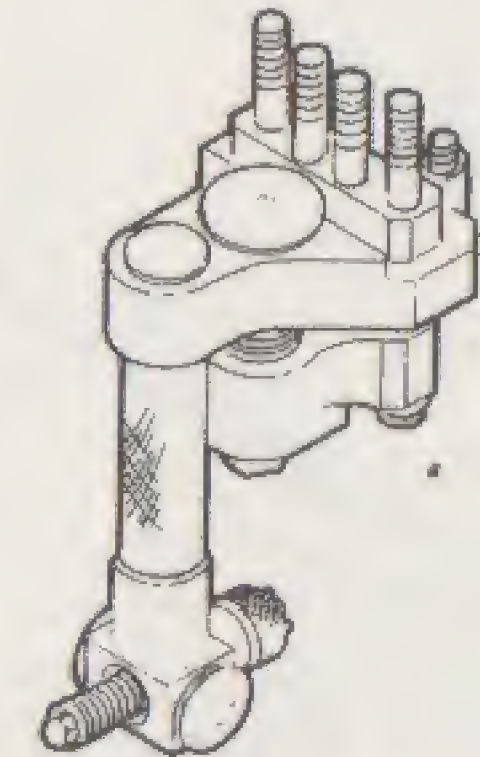
FIGURE 4-15. MAINTENANCE AND REPAIR SET (SHEET 3 OF 3)



INTERFACE SEAL
REMOVAL/INSTALLATION SET

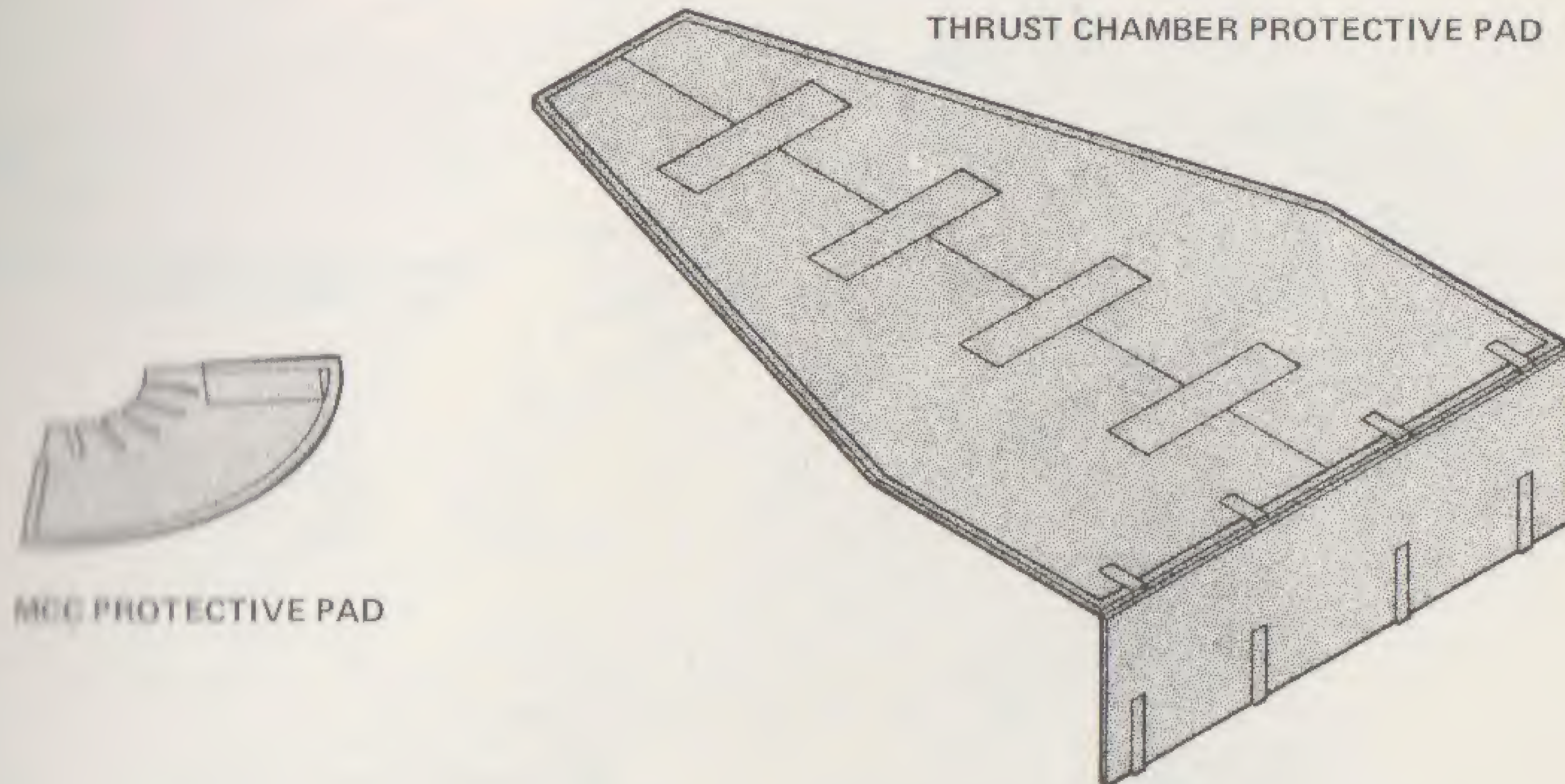


LOW-PRESSURE FUEL
TURBOPUMP RETRACTOR
ASSEMBLY



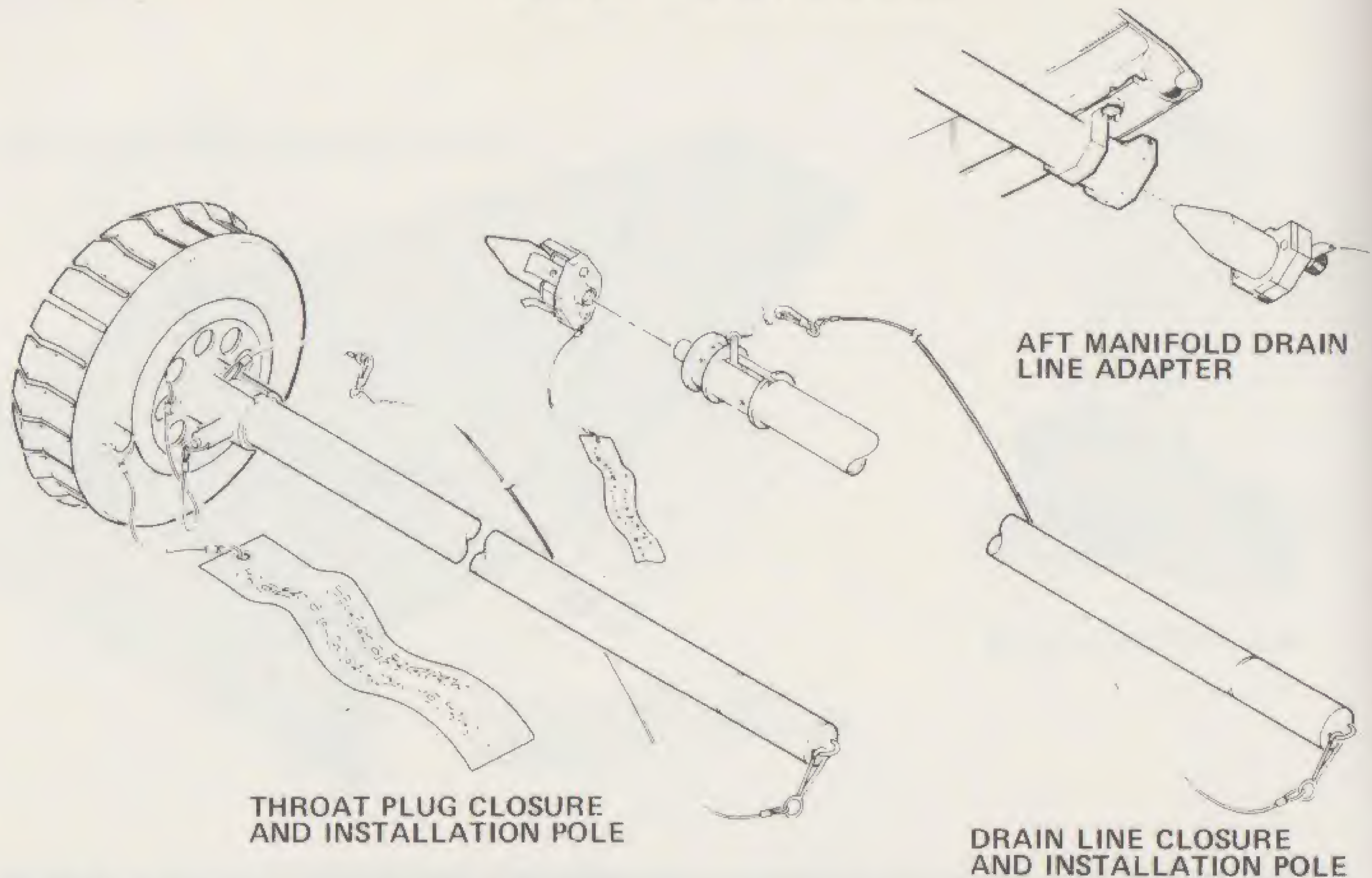
LOW-PRESSURE OXIDIZER
TURBOPUMP RETRACTOR
ASSEMBLY

PURPOSE: SUPPORT LOW-PRESSURE TURBOPUMPS WHILE SEPARATING TURBOPUMPS FROM ORBITER FOR SEAL REPLACEMENT.

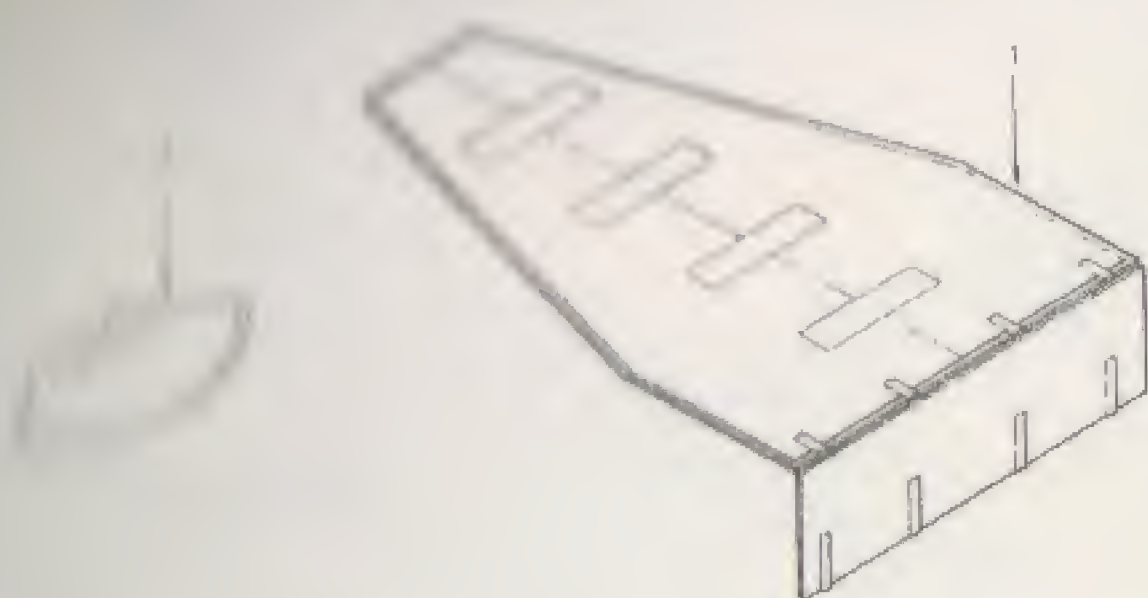


PURPOSE: PROTECT MAIN COMBUSTION CHAMBER AND THRUST CHAMBER NOZZLE TUBES DURING PERSONNEL ENTRY INTO NOZZLE FOR INSPECTIONS AND MAINTENANCE.

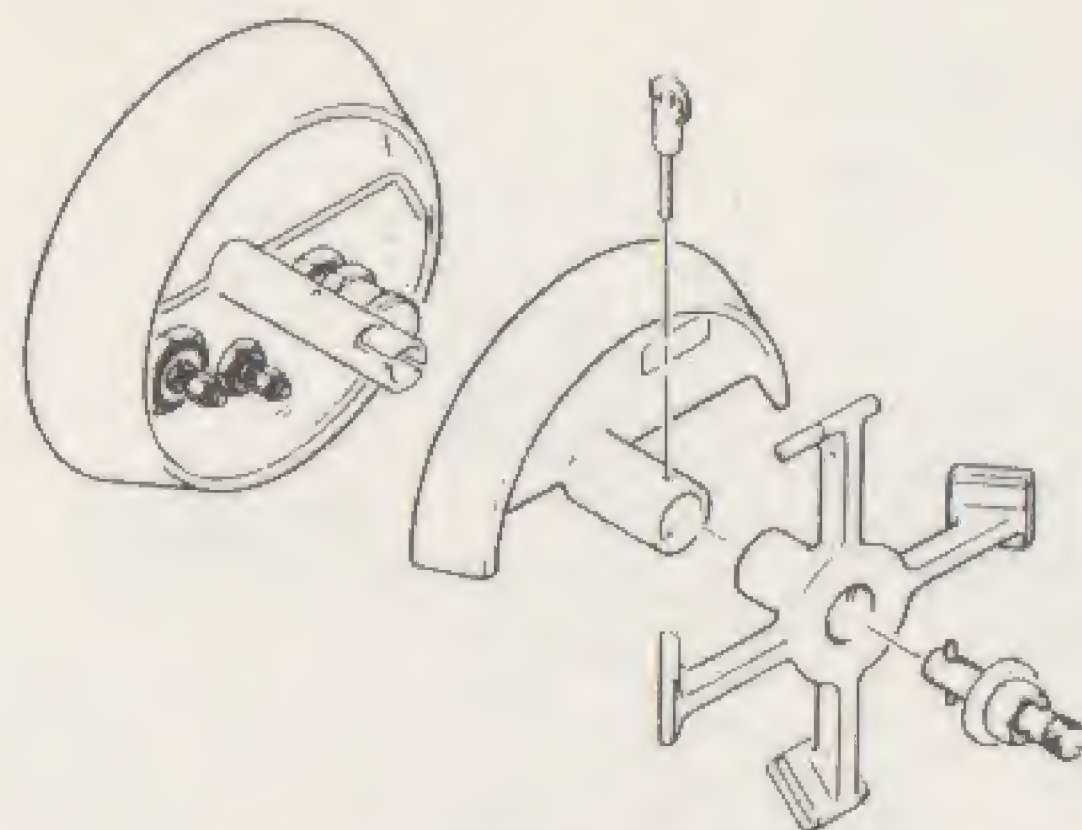
FIGURE 4-17. THRUST CHAMBER PROTECTIVE PAD



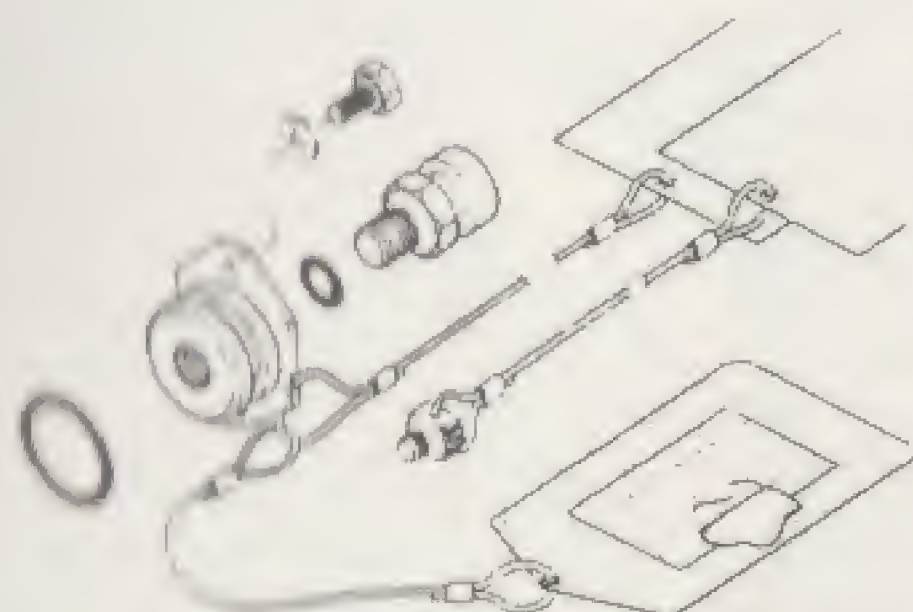
PURPOSE: PROVIDE PROTECTION FROM DUST, SAND, AND RAIN DURING LANDING OPERATIONS.



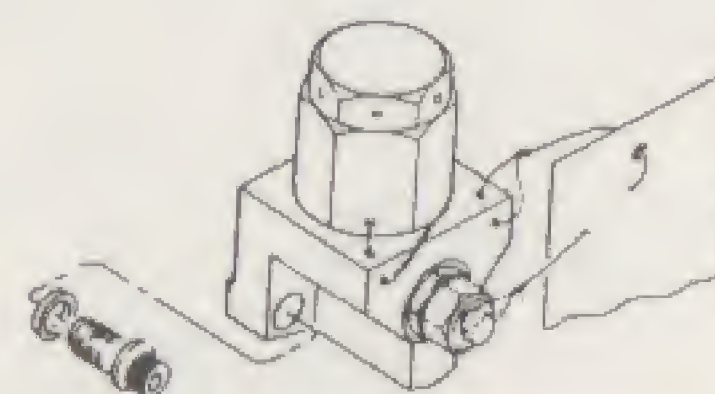
THRUST CHAMBER
PROTECTIVE PAD



THROAT PLUG SET



DRAIN LINE CLOSURE SET

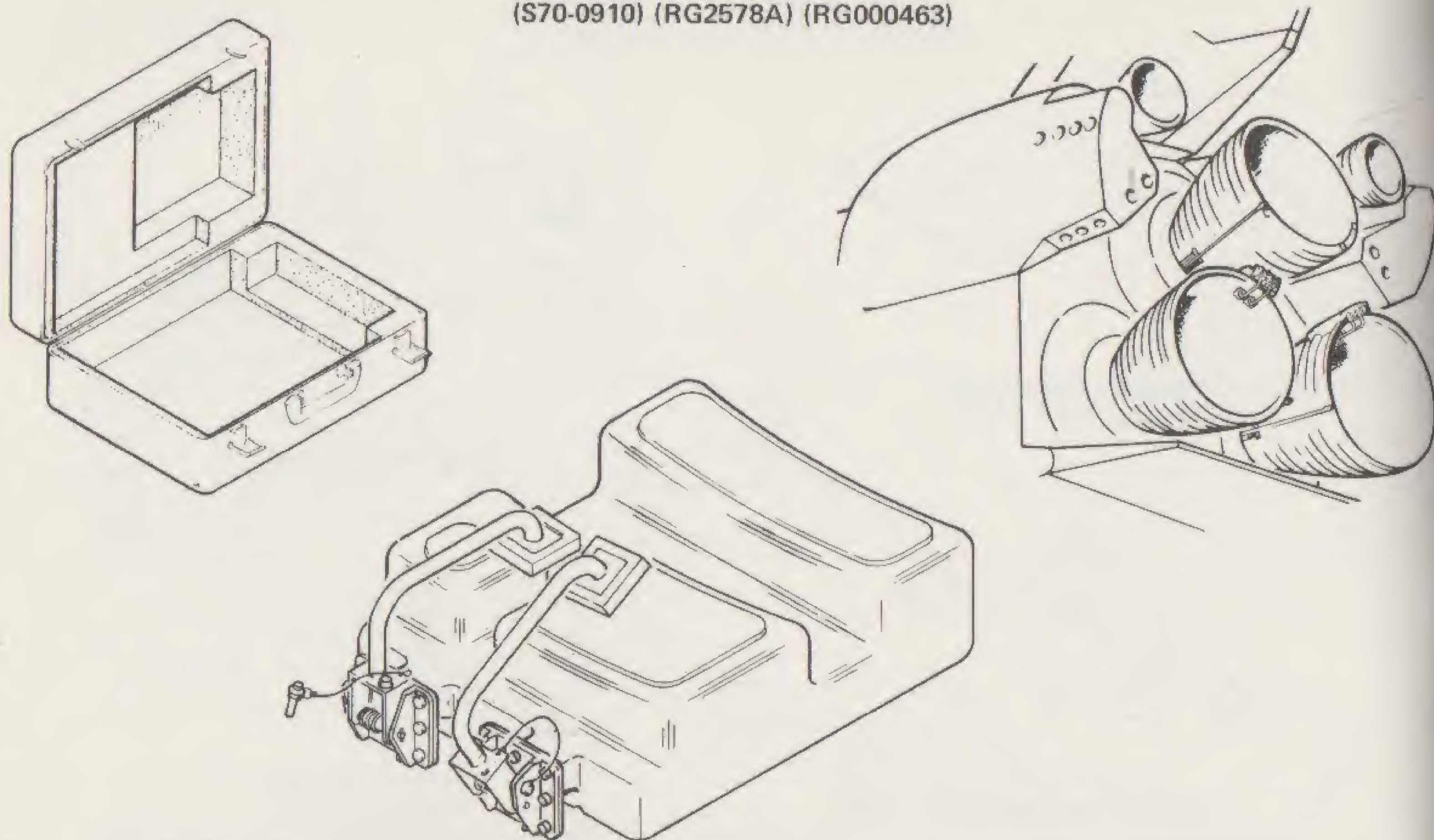


HPFTP DRYING
ADAPTER SET

PURPOSE: CONTAIN PNEUMATIC PRESSURE IN SSME SYSTEMS TO PRECLUDE MOISTURE/CONTAMINANT ENTRY DURING ALTITUDE CHANGES WHEN IN FERRY FLIGHT AND ADAPT HPFTP FOR TURBINE BEARING DRYING.

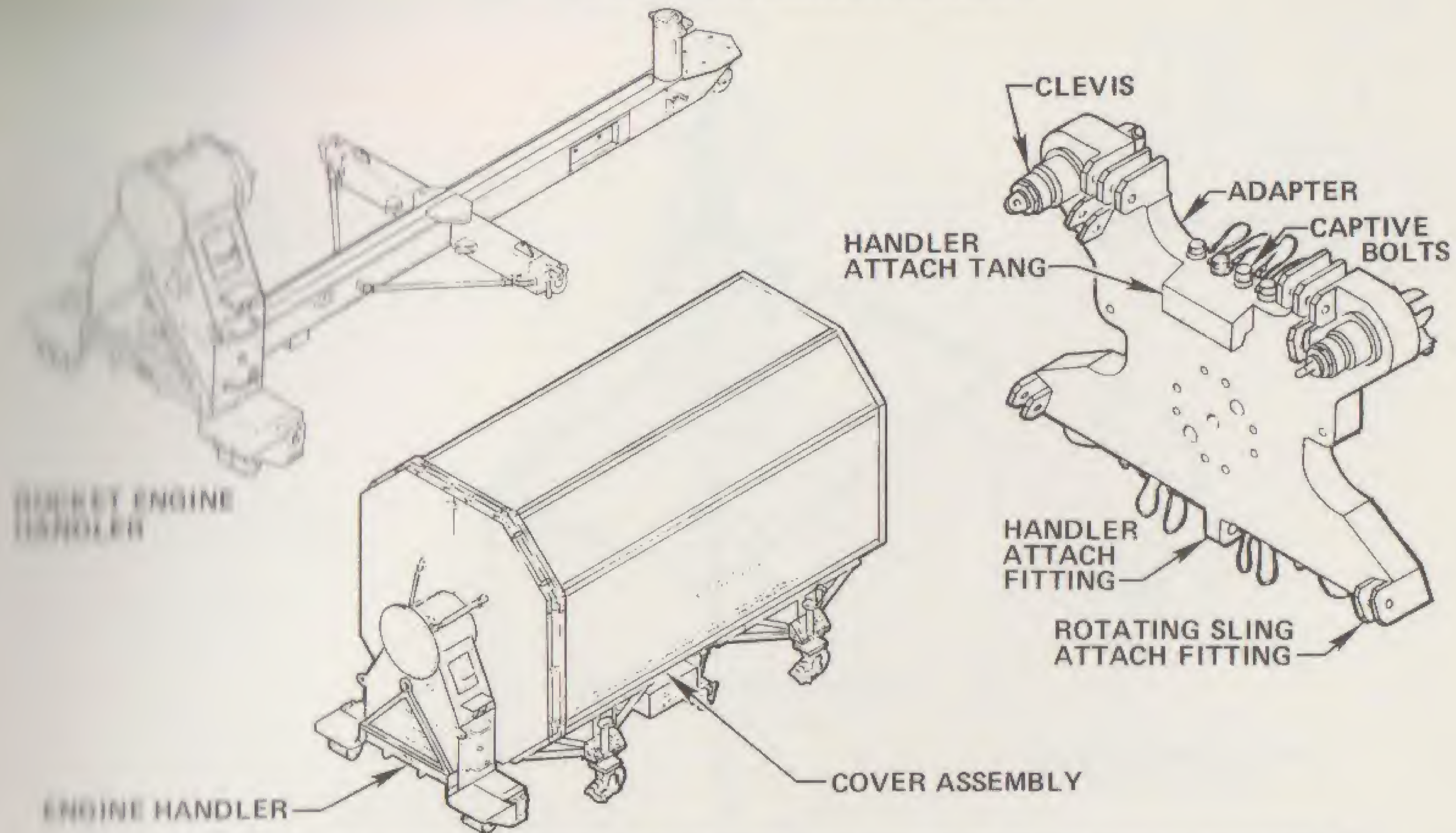
FIGURE 4-19. FERRY FLIGHT SET

(S70-0910) (RG2578A) (RG000463)



PURPOSE: TO PREVENT CONTACT OF DRIFTING NOZZLES IN THE EVENT THAT HYDRAULICS ARE SHUT DOWN AND GIMBAL LOCKS ARE NOT INSTALLED.

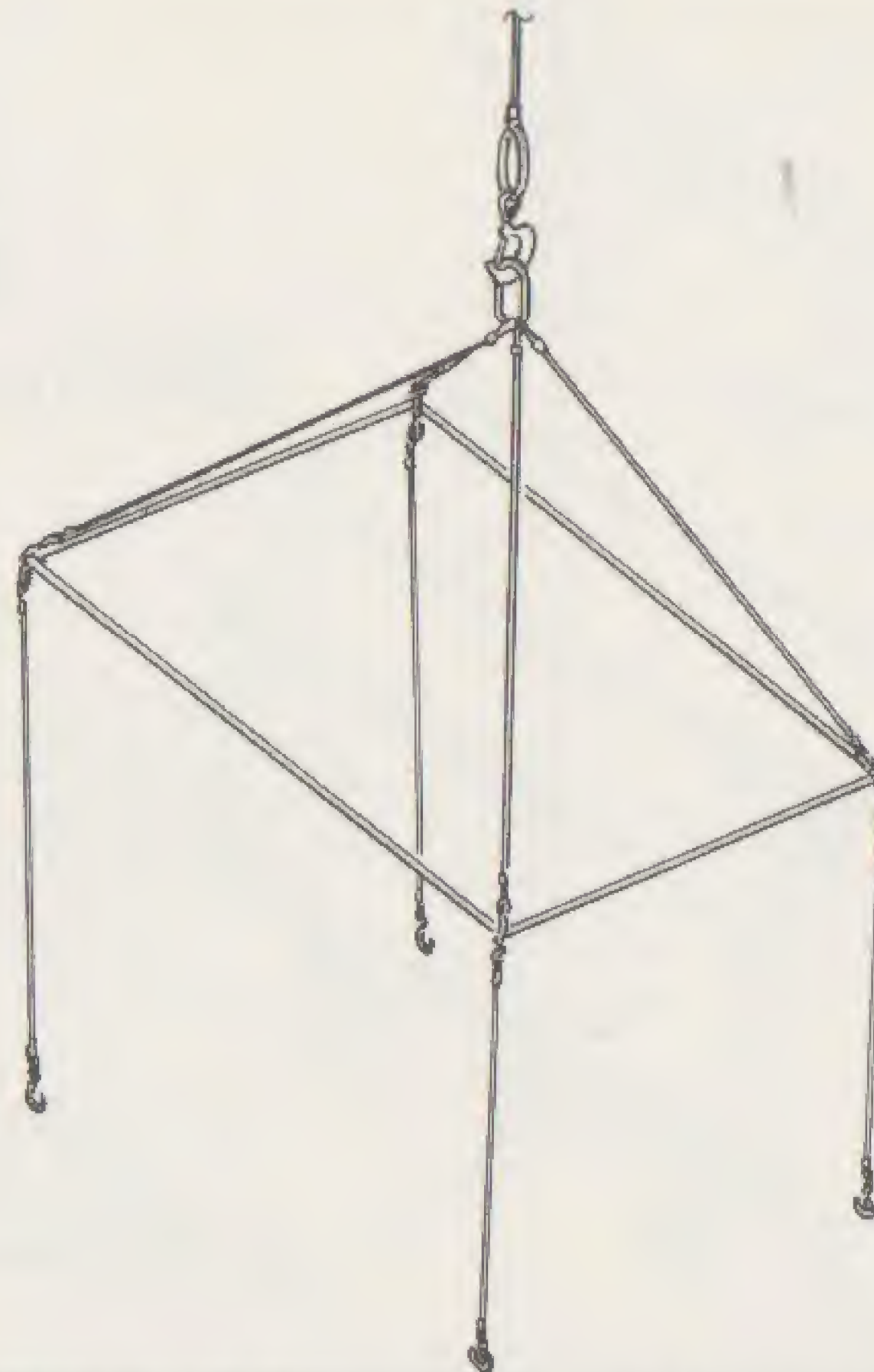
(H70-0901) (RG2502A) (RG000001)



PURPOSE: SHIP AND STORE SSMEs IN HORIZONTAL POSITION AND ROTATE ENGINES FOR MAINTENANCE.

FIGURE 4-21. ENGINE HANDLER

(H70-0902) (RG2505A) (RG000003)

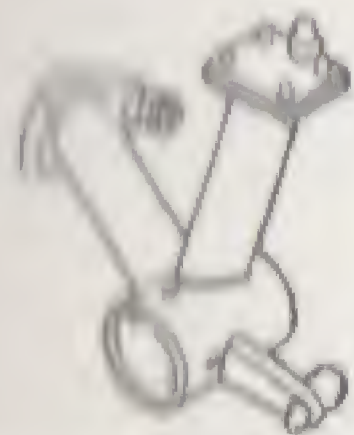


PURPOSE: LIFT ROCKET ENGINE HANDLER WITH OR WITHOUT SSME INSTALLED.

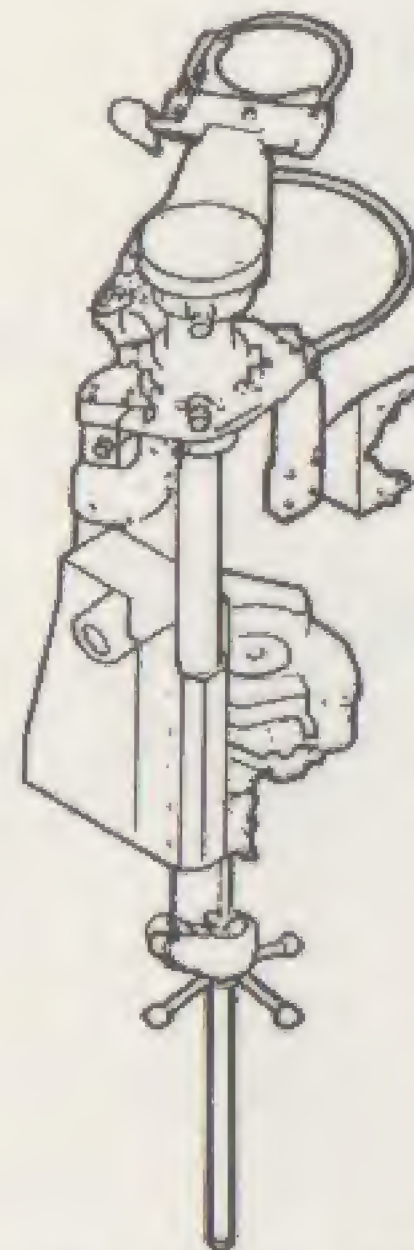
FIGURE 4-22. ENGINE HANDLER SLING



HPFTP HANDLER SLING



LPOTP HANDLER SLING



HPOTP HANDLER SLING

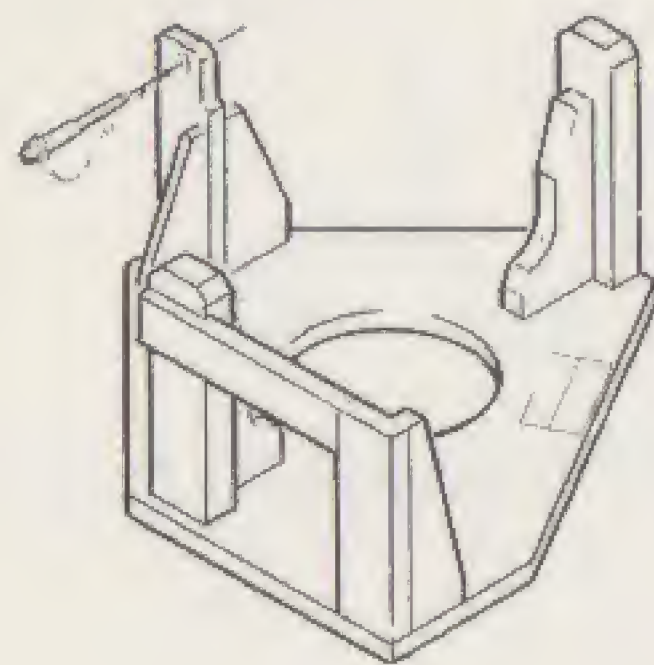


LPFTP HANDLER SLING

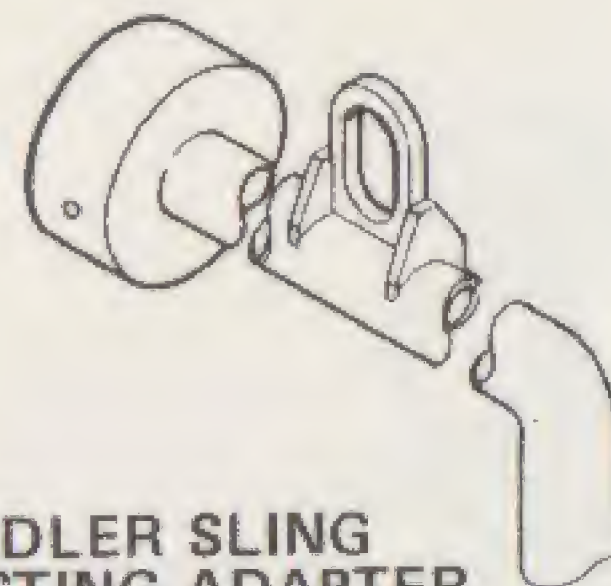


MAINTENANCE AREA
MFV/MOV SLING

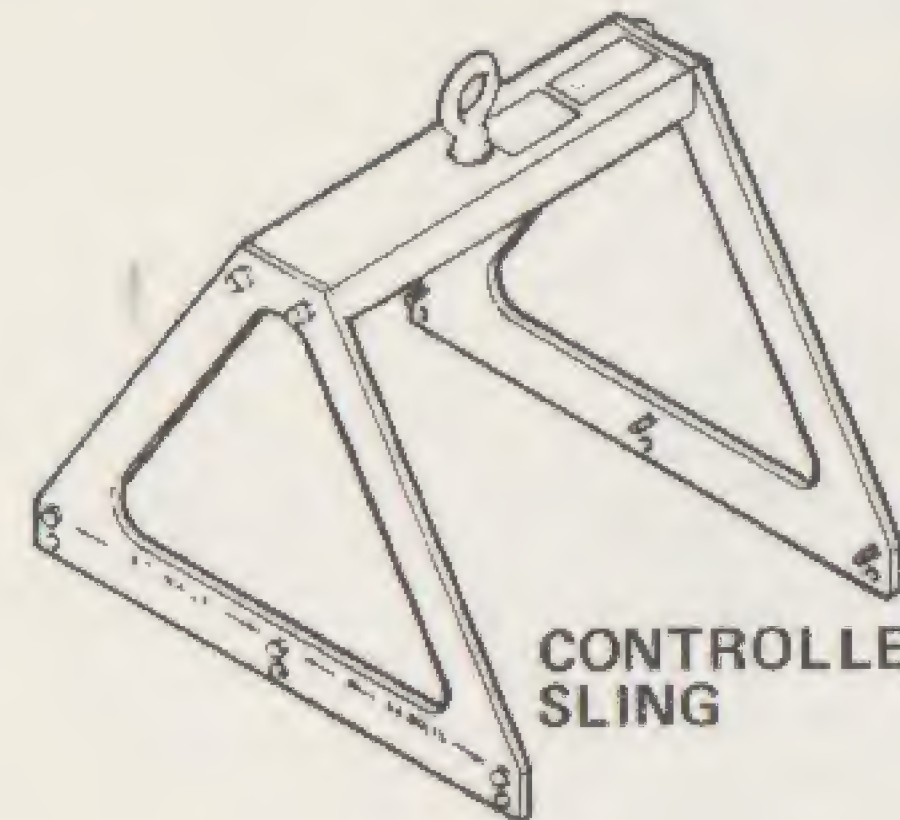
PURPOSE: SUPPORT, LIFT, GUIDE, AND MOVE SELECTED LRUs DURING LRU REMOVAL AND INSTALLATION IN SSME OR SHIPPING CONTAINERS.



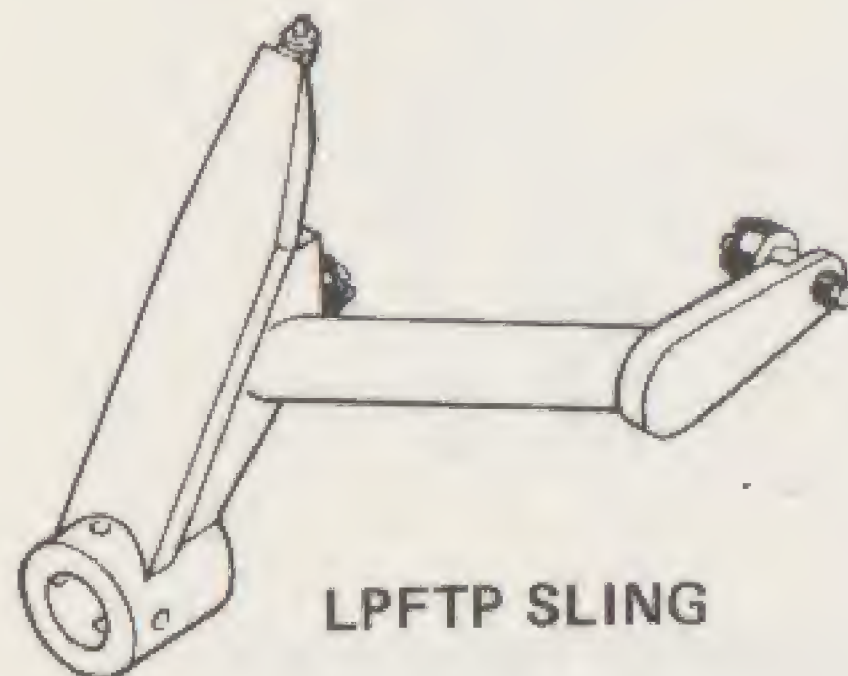
HPFTP SUPPORT STAND



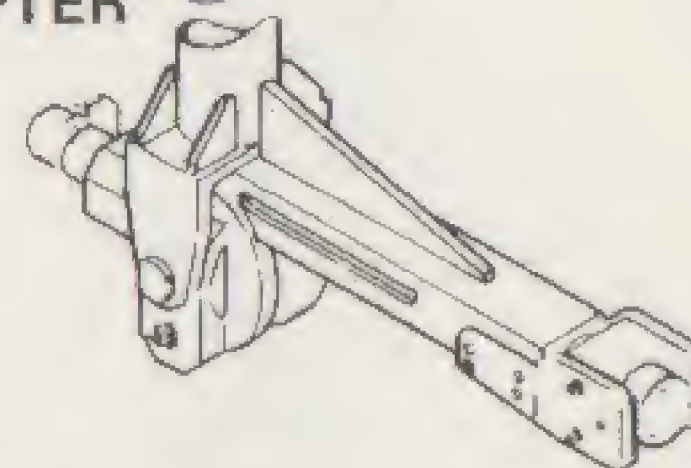
HANDLER SLING
HOISTING ADAPTER



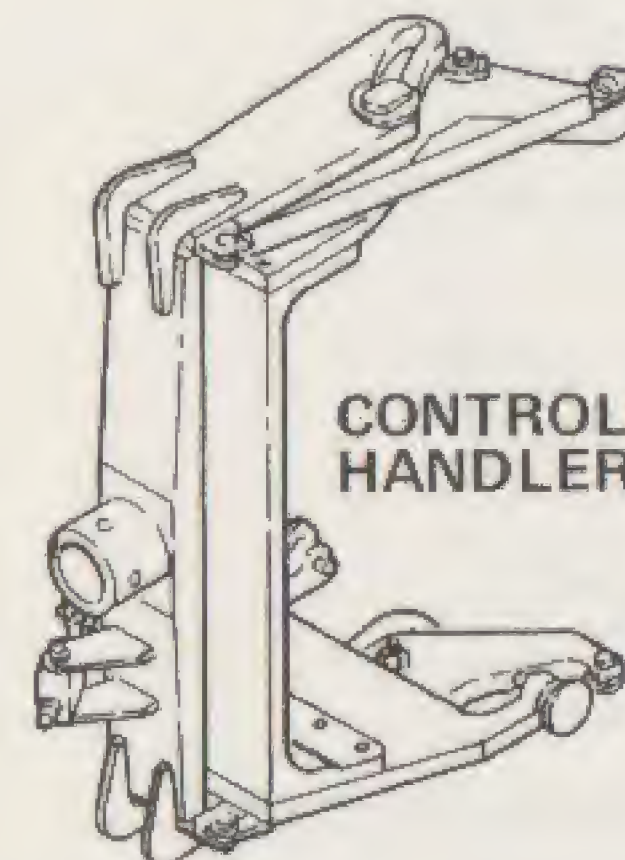
CONTROLLER
SLING



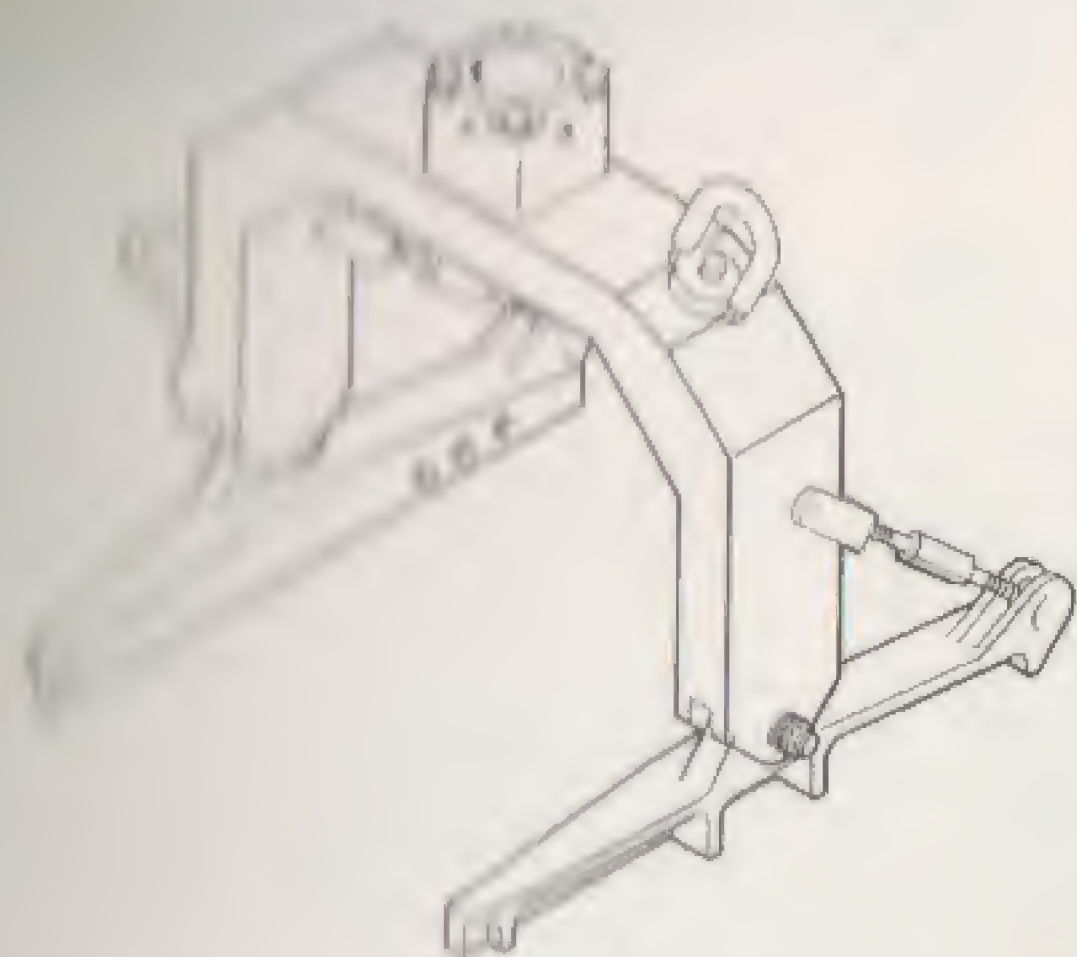
LPFTP SLING



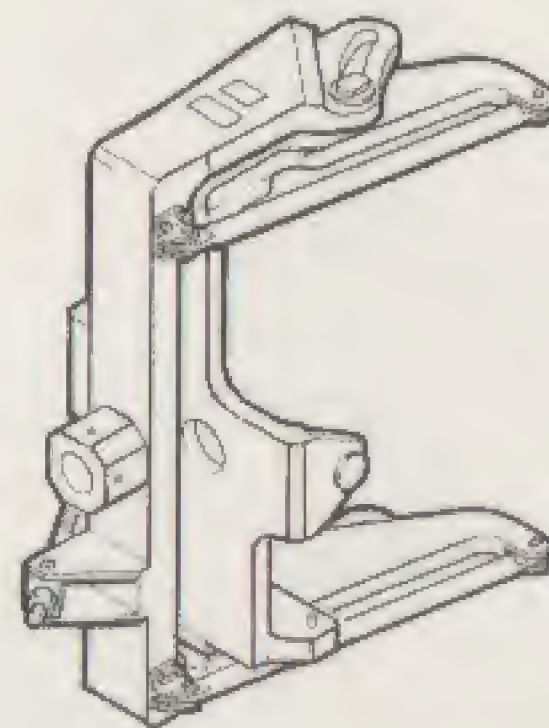
POGO ACCUMULATOR AND
SYSTEM HANDLER SLING



CONTROLLER
HANDLER SLING



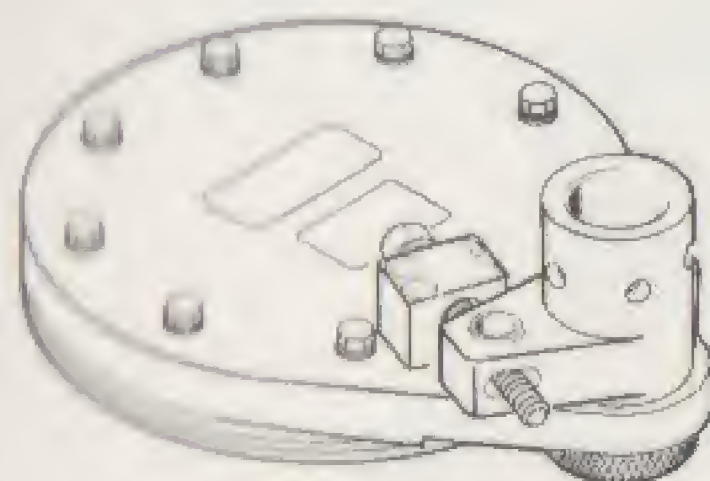
**LIGHTWEIGHT CONTROLLER
HANDLER**



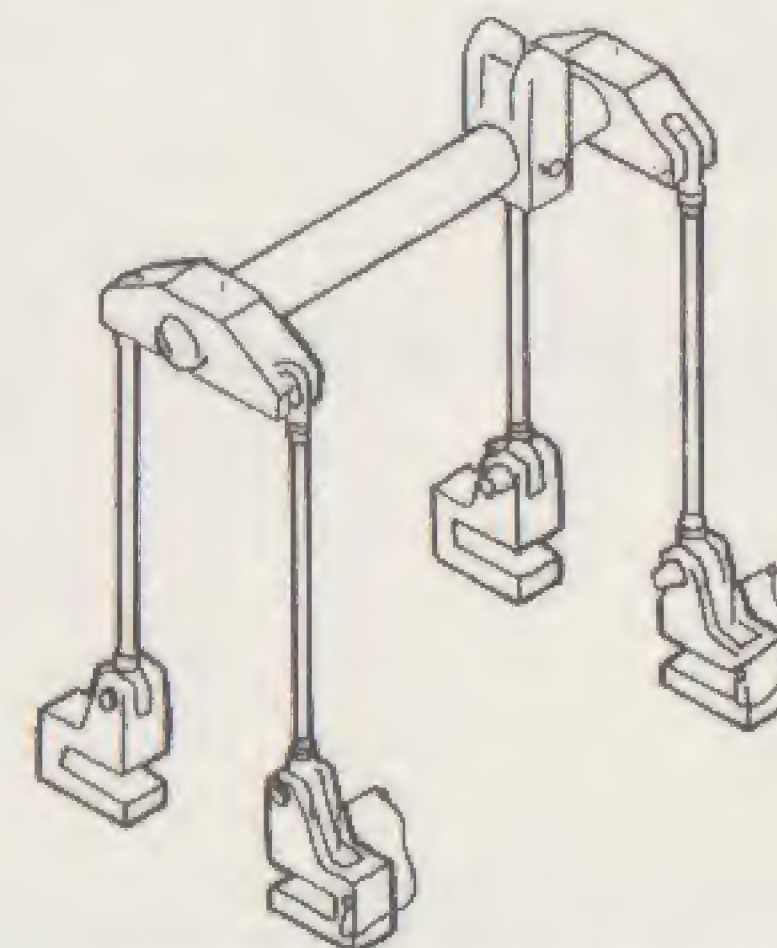
**BLOCK II CONTROLLER
HANDLER**



**MFV/MOV
HANDLER SLING**



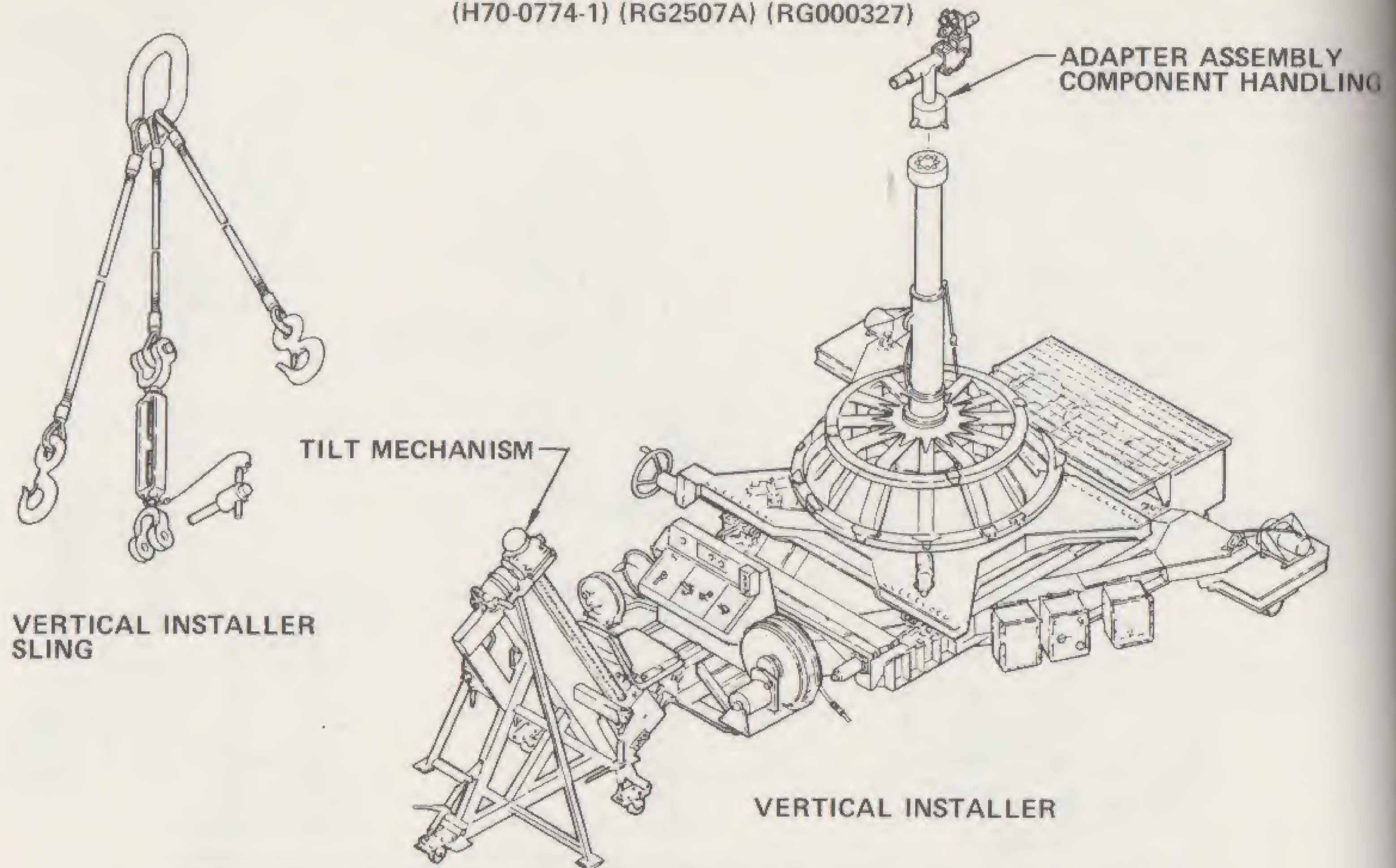
**LPFTP HANDLER
ADAPTER**



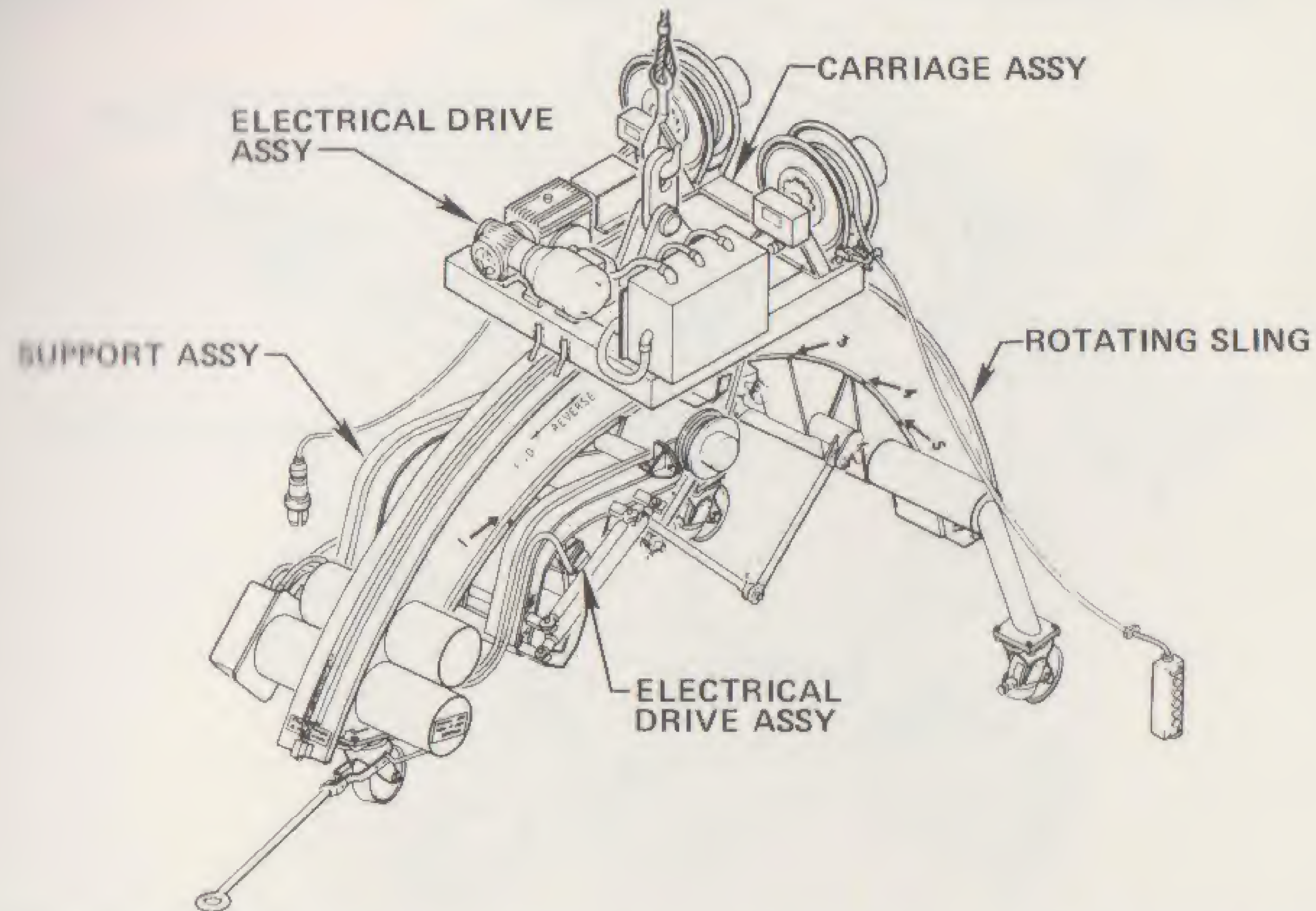
HPTP HANDLER SLING

FIGURE 4-23. COMPONENT HANDLER SLING SET (SHEET 3 OF 3)

(H70-0774-1) (RG2507A) (RG000327)



PURPOSE: INSTALL SSME VERTICALLY INTO ORBITER OR TEST STAND.



PURPOSE: SUPPORT, LIFT, GUIDE, AND ROTATE SSME DURING INSTALLATION AND REMOVAL FROM ROCKET ENGINE HANDLER AND VERTICAL ENGINE INSTALLER.

FIGURE 4-25. ENGINE ROTATING SLING

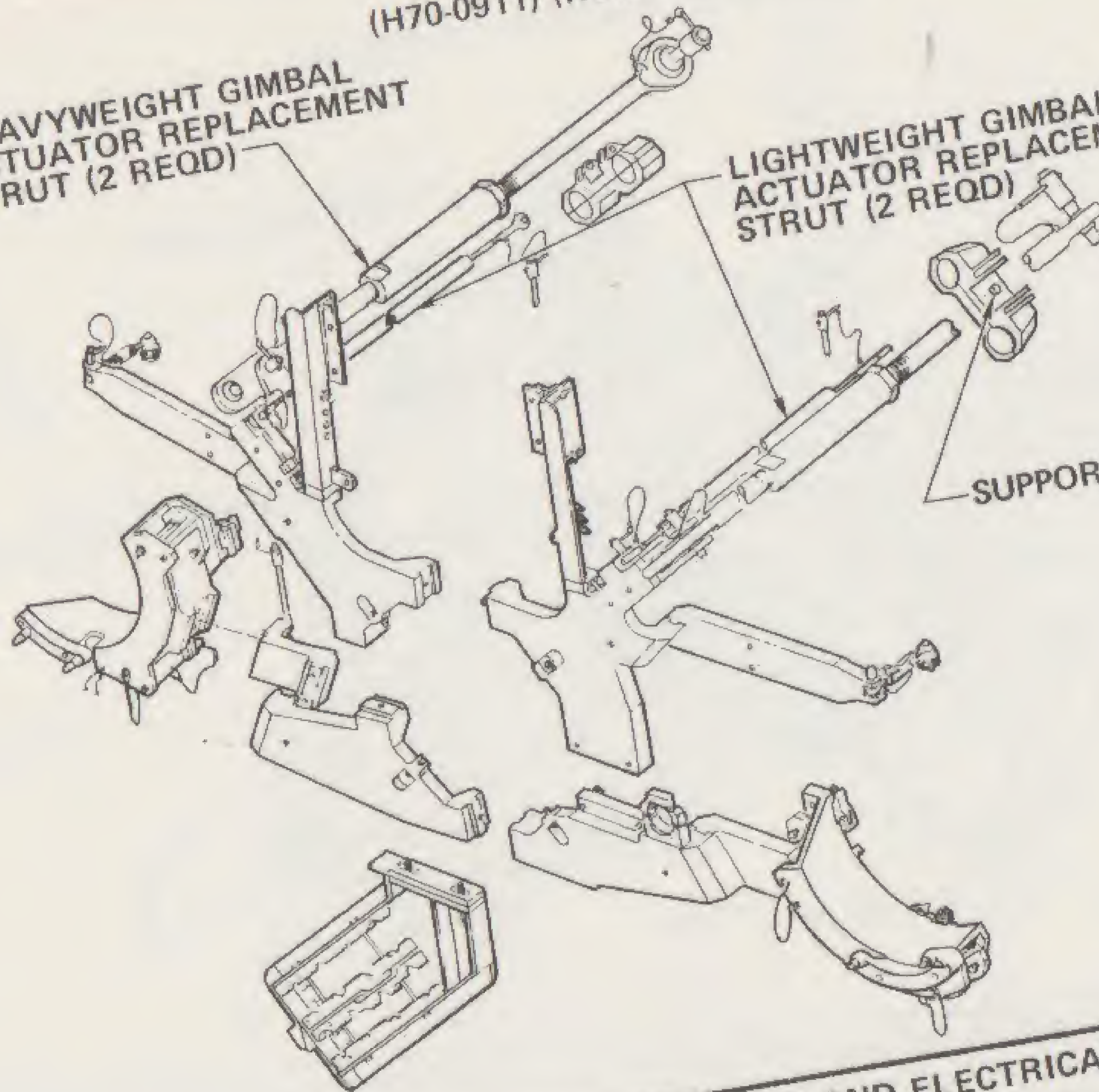
(H70-0774-1) (RG2518A)

(H70-0911) (RG2518A) (RG000350)

HEAVYWEIGHT GIMBAL
ACTUATOR REPLACEMENT
STRUT (2 REQD)

LIGHTWEIGHT GIMBAL
ACTUATOR REPLACEMENT
STRUT (2 REQD)

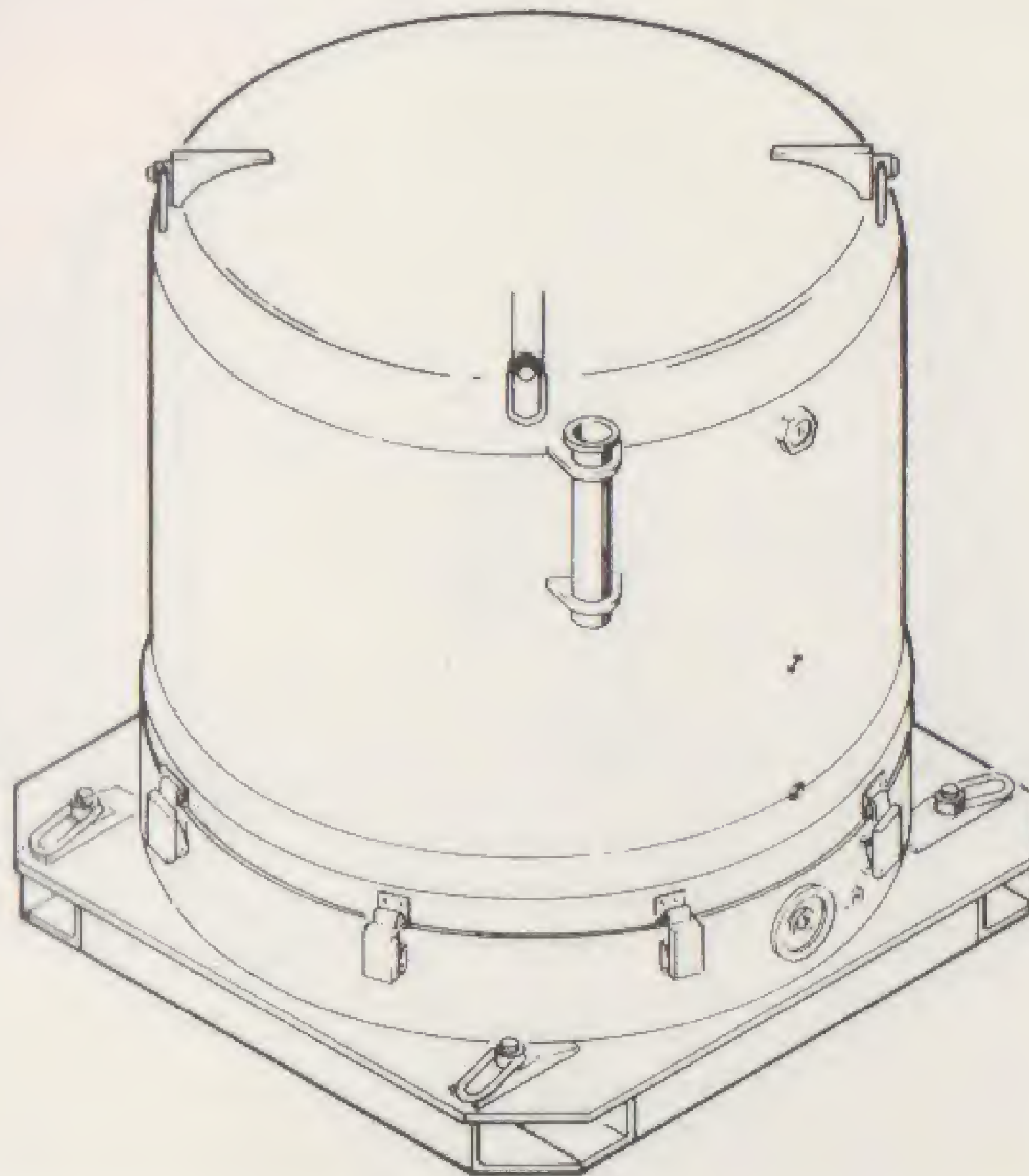
SUPPORT (2 REQD)



PURPOSE: SUPPORT LOW-PRESSURE TURBOPUMPS AND ELECTRICAL AND FLUID INTERFACE
PANELS OF UNINSTALLED ENGINES.

FIGURE 4-26. INTERFACE PANEL AND STRUT SET

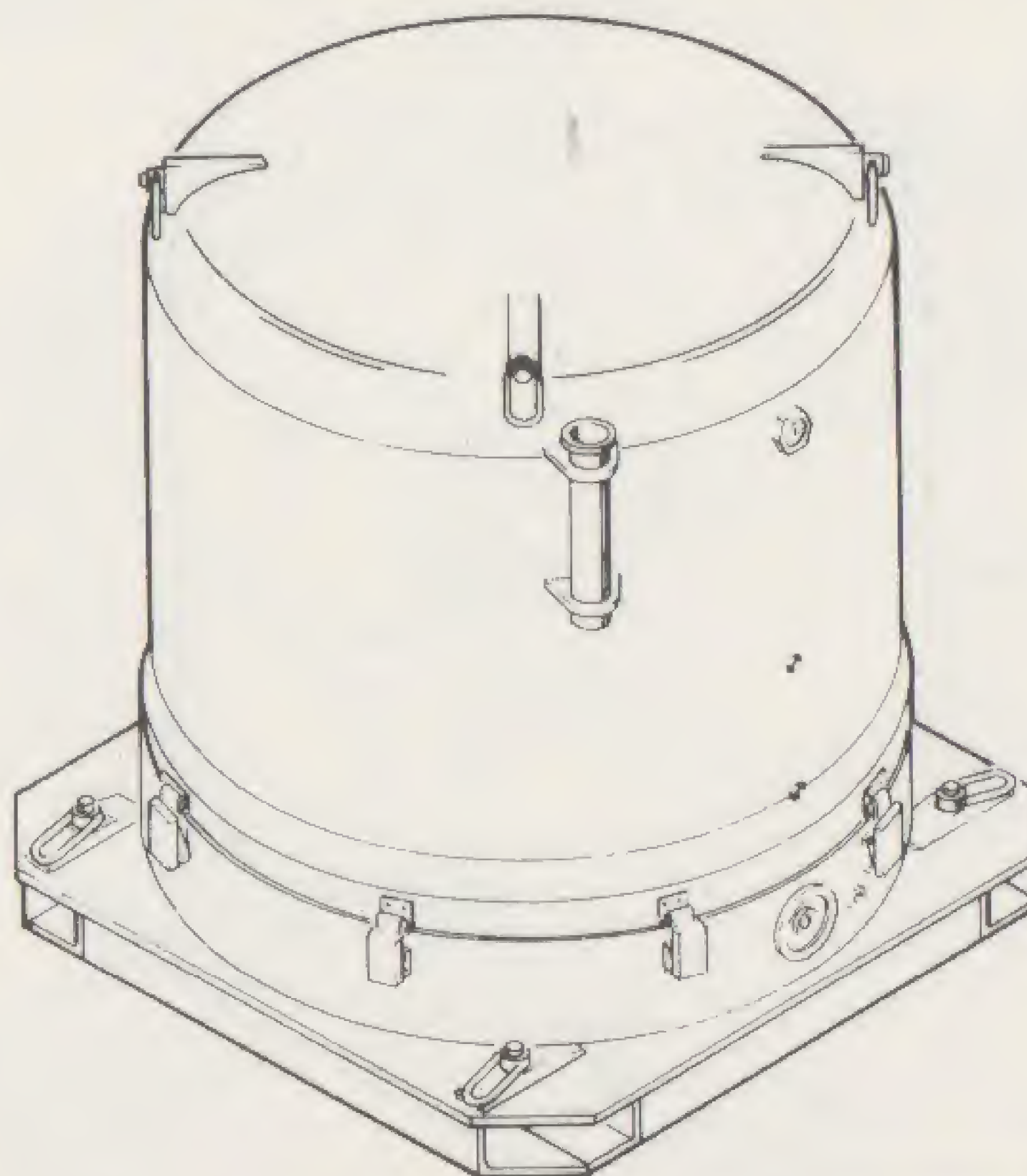
(H70-0906) (RG2591A) (RG000438)



PURPOSE: PROVIDE AN ENVIRONMENTALLY PROTECTED IMPACT-O-GRAPH MONITORED, DESICCANT-SHIELDED CONTAINER FOR THE TRANSPORT AND STORAGE OF THE HIGH-PRESSURE FUEL TURBOPUMP.

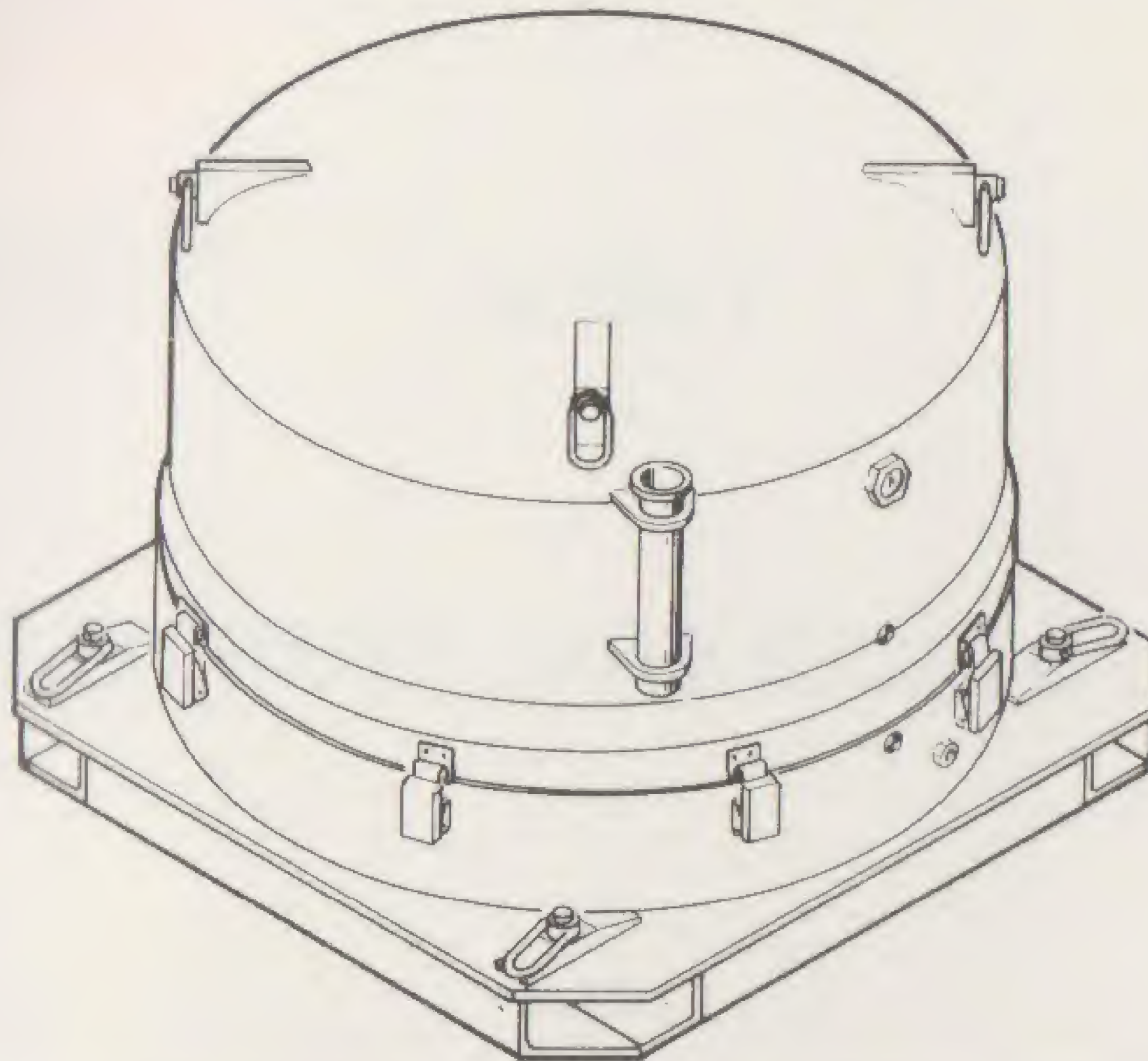
FIGURE 4-27. HIGH-PRESSURE FUEL TURBOPUMP SHIPPING CONTAINER ASSEMBLY

(H70-0907) (RG2592A) (RG000441)



PURPOSE: PROVIDE AN ENVIRONMENTALLY PROTECTED IMPACT-O-GRAPH MONITORED, DESICCANT-SHIELDED CONTAINER FOR THE TRANSPORT AND STORAGE OF THE HIGH-PRESSURE OXIDIZER TURBOPUMP.

(H70-0908) (RG2593A) (RG000442)



PURPOSE: PROVIDE AN ENVIRONMENTALLY PROTECTED IMPACT-O-GRAPH MONITORED, DESICCANT-SHIELDED CONTAINER FOR THE TRANSPORT AND STORAGE OF THE LOW-PRESSURE TURBOPUMPS.

FIGURE 4-29. LOW-PRESSURE TURBOPUMP SHIPPING CONTAINER ASSEMBLY

SECTION V

SHUTTLE FRE/STS LAUNCH HISTORICAL DATA

FRF/ Mission	Date	Challenger 099	Columbia 102	Discovery 103	Atlantis 104	Power Level %	Engine Serial No.			Launch/ Land Sites
							Position No. 1	Position No. 2	Position No. 3	
FRF-01	02-28-81		X			100	2007	2006	2005	DNA
STS-1	04-12-81		X			100	2007	2006	2005	KSC/EAFFB
STS-2	11-12-81		X			100	2007	2006	2005	KSC/EAFFB
STS-3	03-22-82		X			100	2007	2006	2005	KSC/WSSH
STS-4	06-27-82		X			100	2007	2006	2005	KSC/EAFFB
STS-5	11-11-82		X			100	2007	2006	2005	KSC/EAFFB
FRF-02	12-18-82	X				104	2011	2015	2012	DNA
FRF-03	01-25-83	X				104	2011	2015	2012	DNA
STS-6	04-04-83	X				104	2017	2015	2012	KSC/EAFFB
STS-7	06-18-83	X				104	2017	2015	2012	KSC/EAFFB
STS-8	08-30-83	X				100	2017	2015	2012	KSC/EAFFB
STS-9	11-28-83		X			104	2011	2018	2019	KSC/EAFFB
STS-11	02-03-84	X				100	2109	2015	2012	KSC/KSC
STS-13	04-06-84	X				104	2109	2020	2012	KSC/EAFFB
FRF-04	06-02-84			X		100	2021	2018	2017	DNA
STS-14 } ABORT }	06-26-84			X		100	2109	2018	2017	DNA
STS-14	08-30-84			X		104	2109	2018	2021	KSC/EAFFB
STS-17	10-05-84	X				100	2023	2020	2021	KSC/KSC
STS-19	11-08-84			X		104	2109	2018	2012	KSC/KSC
STS-20	01-24-85			X		104	2109	2018	2012	KSC/KSC

FIGURE 5-1. SHUTTLE FRF/STS LAUNCH SUMMARY (SHEET 1 OF 2)

FRF/ Mission	Date	Challenger 099	Columbia 102	Discovery 103	Atlantis 104	Power Level %	Engine Serial No.			Launch/ Land Sites
							Position No. 1	Position No. 2	Position No. 3	
RTB-23	04-12-85			X		100	2109	2018	2012	KSC/KSC
RTB-24	04-29-85	X				104	2023	2020	2021	KSC/EAFB
RTB-26	06-17-85			X		104	2109	2018	2012	KSC/EAFB
RTB-28 (ABORT)	07-12-85	X				104	2023	2020	2021	DNA
RTB-28	07-29-85	X				104	2023	2020	2021	KSC/EAFB
RTB-27	08-27-85			X		104	2109	2018	2012	KSC/EAFB
FRF-06	09-12-85				X	100	2011	2019	2017	DNA
RTB-28	10-03-85				X		2011	2019	2017	KSC/EAFB
RTB-30	10-30-85	X				104	2023	2020	2021	KSC/EAFB
RTB-31	11-26-85				X	104	2011	2019	2017	KSC/EAFB
RTB-32	01-12-86		X			104	2015	2018	2109	KSC/EAFB
RTB-33	01-28-86	X				104	2023	2020	2021	KSC/
FRF-08	08-10-88			X		100	2019	2022	2028	DNA
RTB-26R	09-29-88			X		104	2019	2022	2028	KSC/EAFB
RTB-27R	12-02-88				X	104	2027	2030	2029	KSC/EAFB
RTB-29R	03-13-89			X		104	2031	2022	2028	KSC/EAFB

FIGURE 5-1. SHUTTLE FRF/STS LAUNCH SUMMARY (SHEET 2 OF 2)

FRF-01

ORBITER: COLUMBIA (OV-102)

SSME INITIAL ORBITER INSTALLATION: 07-15-79, 07-18-79, AND 08-04-79

SSME REMOVALS FOR NOZZLE STEERHORN/HPOTP MODS: 12-21-79, 01-03-80, AND 01-04-80

SSME NSTL REACCEPTANCE COMPLETE: 06-23-80, 07-14-80, AND 07-21-80

SSME ORBITER REINSTALLATION: 07-20-80, 07-21-80, AND 08-04-80

SSME REMOVALS FOR FPB LINER MODS: 10-10-80

SSME ORBITER REINSTALLATION: 11-08-80

ROLLOUTS: OPF 11-25-80 VAB 12-29-80

FRF-01: 02-28-81

SSME'S: 2007(1), 2006(2), AND 2005(3)

SSME POWER LEVEL: 100%

SSME FRF-01 SOFTWARE: 81-SSME-0021R1

STS-1

ORBITER: COLUMBIA (OV-102)

FRF-01 CONDUCTED: 02-28-81

● LAUNCH: KSC 04-12-81 07:00 EST

SSME 'S: 2007(1), 2006(2), AND 2005(3)

SSME POWER LEVEL: 100%

SSME FLIGHT SOFTWARE: 81-SSME-0024

PAYLOAD: PRIMARY
DFI, ACIP

SECONDARY
NONE

ASTRONAUTS: COMMANDER: JOHN YOUNG

PILOT: ROBERT CRIPPEN

● LANDING: EAFB 04-14-81 10:21 PST

EAFB - PRIMARY LANDING SITE

HPFTP BEARING PURGES INITIATED - LANDING PLUS 75 HOURS

DFRF PROCESSING TIME - 11 DAYS

STS-2

ORBITER: COLUMBIA (OV-102)
OPF FLOW INITIATION: 04-29-81
OPF SSME PROCESSING TIME: 144 SHIFTS
ROLLOUTS: OPF 08-10-81 VAB 08-31-81
● LAUNCH: KSC 11-12-81 10:10 EST
SSME'S: 2007(1), 2006(2), AND 2005(3)
SSME POWER LEVEL: 100%
SSME FLIGHT SOFTWARE: 81-SSME-0031
PAYLOAD:

<u>PRIMARY</u>	<u>SECONDARY</u>
OSTA-1, PDRS	NONE
OEX	

ASTRONAUTS: COMMANDER: JOE ENGLE PILOT: RICHARD TRULY
● LANDING: EAFB 11-14-81 01:23 PST
EAFB - PRIMARY LANDING SITE
HPFTP BEARING PURGES INITIATED - LANDING PLUS 28 HOURS
DFRF PROCESSING TIME - 9 DAYS
COLUMBIA PREVIOUS MISSIONS: STS-1 (04-12-81)
STS-1 SSME'S: 2007(1), 2006(2), AND 2005(3)

STS-3

ORBITER: COLUMBIA (OV-102)

OPF FLOW INITIATION: 11-25-81

OPF SSME PROCESSING TIME: 57 SHIFTS

ROLLOUTS: OPF 02-03-82 VAB 02-16-82

● LAUNCH: KSC 03-22-82 11:00 EST

SSME'S: 2007(1), 2006(2), AND 2005(3)

SSME POWER LEVEL: 100%

SSME FLIGHT SOFTWARE: 81-SSME-0031

PAYLOAD: PRIMARY
OSS-1, OEX

SECONDARY
NONE

ASTRONAUTS: COMMANDER: JACK LOUSMA

PILOT: C. GORDON FULLERTON

● LANDING: WSSH 03-30-82 09:05 MST
EAFB PRIMARY - SWITCH TO WSSH LAUNCH - 4 DAYS
HPFTP BEARING PURGES INITIATED - LANDING PLUS 24 HOURS
WSSH PROCESSING TIME - 5 DAYS

COLUMBIA PREVIOUS MISSIONS: STS-1 AND STS-2 (08-10-81)

STS-2 SSME'S: 2007(1), 2006(2), AND 2005(3)

STS-4

ORBITER: COLUMBIA (OV-102)

OPF FLOW INITIATION: 03-08-82

OPF SSME PROCESSING TIME: 66 SHIFTS

ROLLOUTS: OPF 05-19-82 VAB 05-26-82

● LAUNCH: KSC 06-27-82

SSME'S: 2007(1), 2006(2), AND 2005(3)

SSME POWER LEVEL: 100%

SSME FLIGHT SOFTWARE: 82-SSME-0033R2

PAYLOAD: PRIMARY
DOD 82-1

SECONDARY
MBR, DFI,
GAS, ACIP

ASTRONAUTS: COMMANDER: THOMAS MATTINGLY II PILOT: HENRY HARTSFIELD JR.

● LANDING: EAFB 07-04-82 · 09:09 PST
EAFB - PRIMARY LANDING SITE
HPFTP BEARING PURGES INITIATED - LANDING PLUS 34 HOURS
DFRF PROCESSING TIME - 9 DAYS

COLUMBIA PREVIOUS MISSIONS: STS-1, STS-2, AND STS-3 (03-22-82)

STS-3 SSME'S: 2007(1), 2006(2), AND 2005(3)

STS-5

ORBITER: COLUMBIA (OV-102)

OPF FLOW INITIATION: 07-16-82

OPF SSME PROCESSING TIME: 63 SHIFTS

ROLLOUTS: OPF 09-09-82 VAB 09-21-82

● LAUNCH: KSC 11-11-82 07:19 EST

SSME'S: 2007(1), 2006(2), AND 2005(3)

SSME POWER LEVEL: 100%

SSME FLIGHT SOFTWARE: 82-SSME-0035R4

PAYLOAD: PRIMARY
SBS-C,
TELESAT-E

SECONDARY
GLOW, SSIP (3),
GAS (1)

ASTRONAUTS: COMMANDER: VANCE BRAND PILOT: ROBERT OVERMYER
MISSION SPECIALISTS: JOSEPH ALLEN, WILLIAM LENOIR

● LANDING: EAFB 11-16-82 06:33 PST
EAFB - PRIMARY LANDING SITE
HPFTP BEARINGS PURGES INITIATED - LANDING PLUS 27 HOURS
DFRF PROCESSING TIME - 4 DAYS

COLUMBIA PREVIOUS MISSIONS: STS-1, STS-2, STS-3, AND STS-4 (06-27-82)

STS-4 SSME'S: 2007(1), 2006(2), AND 2005(3)

FRF-02

ORBITER: CHALLENGER (OV-099)

SSME INSTALLATION: 10-21-82, 10-25-82, AND 11-10-82

ROLLOUTS: OPF 11-23-82 VAB 11-30-82

FRF-02: 12-18-82

SSME'S: 2011(1), 2015(2), AND 2012(3)

SSME POWER LEVEL: 104%

SSME FRF-02 SOFTWARE: 83-SSME-0043R2

FRF-03 (PRE STS-6)

ORBITER: CHALLENGER (OV-099)

FRF-03: CONDUCTED TO EVALUATE HYDROGEN AFT FUSELAGE CONTENT

FRF-03: 01-25-83

SSME'S: 2011(1), 2015(2), AND 2012(3)

SSME POWER LEVEL: 104%

SSME SOFTWARE: 83-SSME-0047R1

STS-6

ORBITER: CHALLENGER (OV-099)

OPF FLOW INITIATION:

OPF SSME PROCESSING TIME: DNA - FRF TURNAROUND

ROLLOUTS: OPF 11-23-83 VAB 11-30-83

● LAUNCH: KSC 04-04-83 13:30 EST

SSME'S: 2017(1), 2015(2), AND 2012(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 83-SSME-0048

PAYLOAD: PRIMARY
TDRS-1

SECONDARY
CFES, MLR, NOSL, AND GAS (3)

ASTRONAUTS: COMMANDER: PAUL WEITZ PILOT: KAROL BOBKO
MISSION SPECIALISTS: DONALD PETERSON, STORY MUSGRAVE

● LANDING: EAFB 04-09-83 10:49 PDT
EAFB - PRIMARY LANDING SITE
HPFTP BEARING PURGES INITIATED - LANDING PLUS 17 HOURS
DFRF PROCESSING TIME - 4 DAYS

CHALLENGER PREVIOUS MISSIONS: NONE

STS-7

ORBITER: CHALLENGER (OV-099)

OPF FLOW INITIATION: 04-18-84

OPF SSME PROCESSING TIME: 52 SHIFTS

ROLLOUTS: OPF 05-21-83 VAB 05-26-83

● LAUNCH: KSC 06-18-83 07:33 EDT

SSME'S: 2017(1), 2015(2), AND 2012(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 83-SSME-0049R1

PAYLOAD:

PRIMARY

SPAS-01, OSTA-2

TELESAT-F, PALAPA-B1

SECONDARY

CFES, MLR,
GAS (7)

ASTRONAUTS:

COMMANDER: ROBERT CRIPPEN

PILOT: FREDERICK HAUCK

MISSION SPECIALISTS: JOHN FABIAN, SALLY RIDE, NORMAN THAGARD

● LANDING:

EAFB 06-24-83 06:57 PDT

EAFB - SECONDARY LANDING SITE

HPFTP BEARING PURGES INITIATED - LANDING PLUS 40 HOURS 18 MINUTES

DFRF PROCESSING TIME - 5 DAYS

CHALLENGER PREVIOUS MISSIONS: STS-6 (04-04-83)

STS-6 SSME'S: 2017(1), 2015(2), AND 2012(3)

STS-8

ORBITER: CHALLENGER (OV-099)
OFF FLOW INITIATION: 06-30-83
OFF SSME PROCESSING TIME: 24 SHIFTS
ROLL OUTS: OPF 07-26-83 VAB 08-01-83
LAUNCH: KSC 08-30-83 02:32 EST
SSME'S: 2017(1), 2015(2), AND 2012(3)
SSME POWER LEVEL: 100%
SSME FLIGHT SOFTWARE: 83-SSME-0051
PAYLOAD:

<u>PRIMARY</u>	<u>SECONDARY</u>
PDRS/PFTA, OIM	CFES, RME, GAS(4),
INSAT I-B	SSIP (1)

ASTRONAUTS: COMMANDER: RICHARD TRULY PILOT: DANIEL BRANDENSTEIN
MISSION SPECIALISTS: DALE GARDNER, GUION BLUFORD, WILLIAM THORNTON

LANDING: EAFB 09-05-83 00:41 PDT
EAFB - PRIMARY LANDING SITE
HPFTP BEARING PURGES INITIATED - LANDING PLUS 18 HOURS 20 MINUTES
DFRF PROCESSING TIME - 4 DAYS

CHALLENGER PREVIOUS MISSIONS: STS-6 AND STS-7 (06-18-83)
STS-7 SSME'S: 2017(1), 2015(2), AND 2012(3)

STS-9 (MISSION 41-A)

ORBITER: COLUMBIA (OV-102)

SSME ENGINE INSTALLATION: 06-02-83, 07-18-83, AND 07-19-83

OPF SSME PROCESSING TIME: DNA - NEW ENGINES

ROLLOUTS: OPF 11-03-83 VAB 11-08-83

● LAUNCH: KSC 11-28-83 11:00 EST

SSME'S: 2011(1), 2018(2), AND 2019(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 83-SSME-0052R4

PAYLOAD:
PRIMARY
SPACELAB 1

SECONDARY
NONE

ASTRONAUTS: COMMANDER: JOHN YOUNG

PILOT: BREWSTER SHAW

MISSION SPECIALISTS: OWEN GARRIOTT, ROBERT PARKER

PAYLOAD SPECIALISTS: BYRON LICHTENBERG, ULF MERBOLD (W. GERMANY)

● LANDING: EAFB 12-08-83 15:47 PST
EAFB - PRIMARY LANDING SITE
HPFTP BEARING PURGES INITIATED - LANDING PLUS 19 HOURS 32 MINUTES
DFRF PROCESSING TIME - 6 DAYS

COLUMBIA PREVIOUS MISSIONS: STS-1, STS-2, STS-3, STS-4, AND STS-5 (11-11-82)

STS-5 SSME'S: 2007(1), 2006(2), AND 2005(3)

STS-11 (MISSION 41-B)

ORBITER: CHALLENGER (OV-099) (STS-10 DELETED)

OPF FLOW INITIATION: 09-11-83

OPF SSME PROCESSING TIME: 43.5 SHIFTS

ROLLOUTS: OPF 01-06-84 VAB 01-12-84

● LAUNCH: KSC 02-03-84

SSME'S: 2109(1), 2015(2), AND 2012(3)

SSME POWER LEVEL: 100%

SSME FLIGHT SOFTWARE: 83-SSME-0054R3

<u>PAYLOAD:</u>	<u>PRIMARY</u>	<u>SECONDARY</u>
	SPAS-01A, PALAPA B-2 WESTAR VI	ACES, IEF, C-360c+b RME, MLR, GAS(5), SSIP(1), IRT

ASTRONAUTS: COMMANDER: VANCE BRAND PILOT: ROBERT GIBSON

MISSION SPECIALISTS: BRUCE MCCANDLESS, ROBERT STEWART,
RONALD MCNAIR

● LANDING: KSC 02-11-84 07:16 EST
HPFTP BEARING PURGES INITIATED - LANDING PLUS 21 HOURS 14 MINUTES

CHALLENGER PREVIOUS MISSIONS: STS-6, STS-7, AND STS-8 (08-30-83)

STS-8 SSME'S: 2017(1), 2015(2), AND 2012(3)

STS-13 (MISSION 41-C)

ORBITER: CHALLENGER (OV-099) (STS-12 DELETED)

OPF FLOW INITIATION: 02-12-84

OPF SSME PROCESSING TIME: 30.5 SHIFTS

ROLLOUTS: OPF 03-14-84 VAB 03-19-84

● LAUNCH: KSC 04-06-84 08:58 EST

SSME'S: 2109(1), 2020(2), AND 2012(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 84-SSME-0059R3

<u>PAYLOAD:</u>	<u>PRIMARY</u>	<u>SECONDARY</u>
	LDEF-1, SMM REPAIR	RME, IMAX, C-360b SSIP(1)

ASTRONAUTS: COMMANDER: ROBERT CRIPPEN PILOT: FRANCIS SCOBEE

MISSION SPECIALISTS: GEORGE NELSON, TERRY HART, JAMES VAN HOF TEN

● LANDING: EAFB 04-13-84 05:38 PST
EAFB - SECONDARY LANDING SITE
HPFTP BEARING PURGES INITIATED - LANDING PLUS 41.5 HOURS
DFRF PROCESSING TIME - 4 DAYS

CHALLENGER PREVIOUS MISSIONS: STS-6, STS-7, STS-8, AND STS-11 (02-03-84)

STS-11 SSME'S: 2109(1), 2015(2), AND 2012(3)

FRF-04

ORBITER: DISCOVERY (OV-103)

SSME INSTALLATIONS: 01-10-84, 02-07-84, AND 04-12-84 (SSME 2020 INSTALLED 01-12-84, BUT REMOVED 02-17-84 FOR INSTALLATION IN CHALLENGER).

ROLLOUTS: OPF 05-12-84 VAB 05-19-84

FRF-04: 06-02-84

SSME'S: 2021(1), 2018(2), AND 2017(3)

SSME POWER LEVEL: 100%

SSME FRF-04 SOFTWARE: 83-SSME-0055R6

STS-14 (MISSION 41-D)

ORBITER: DISCOVERY (OV-103)
OPF FLOW INITIATION: DNA
OPF SSME PROCESSING TIME: DNA - FRF TURNAROUND
ROLLOUTS: OPF 05-12-84 VAB 05-19-84
● ABORT: KSC 06-26-84 08:43 EDT SSME'S 2109(1), 2018(2), AND 2017(3)
POWER LEVEL: 100% SSME FLIGHT SOFTWARE: 84-SSME-00635
PAYLOAD: PRIMARY SECONDARY
 OSTA-1, LFC CFES III, IMAX, RME,
 TELESAT-1, SYNCOM IV-1 C-360b, SSIP (1)
ROLLBACK: PAD 07-14-84 VAB 07-16-84
ROLLOUT: OPF 08-02-84 PAD 08-09-84
● LAUNCH: KSC 08-30-84 08:42 EDT
SSME'S: 2109(1), 2018(2), AND 2021(3)
SSME POWER LEVEL: 104%
SSME FLIGHT SOFTWARE: 84-SSME-0063R8
PAYLOAD: PRIMARY SECONDARY
 OSTA-1, SBS-D CFES III, IMAX,
 TELSTAR 3-C, SYNCOM IV-2 RME, SSIP (1), CLOUDS
ASTRONAUTS: COMMANDER: HENRY HARTSFIELD PILOT: MICHAEL COATS
 MISSION SPECIALISTS: JUDITH RESNIK, STEVEN HAWLEY,
 RICHARD MULLANE
 PAYLOAD SPECIALIST: CHARLES WALKER
● LANDING: EAFB 09-05-84 06:37 PST
 HPFTP BEARING PURGES INITIATED - LANDING PLUS 20 HOURS 27 MINUTES
 DFRF PROCESSING TIME - 4 DAYS
DISCOVERY PREVIOUS MISSIONS: NONE

STS-17 (MISSION 41-G)

ORBITER: CHALLENGER (OV-099)

SSME INSTALLATION: 07-20-84 (SSME'S 2020 AND 2023)

ROLLOUTS: OPF 04-23-84 VAB 09-09-84

● LAUNCH: KSC 10-05-84 07:03 EDT

SSME'S: 2023(1), 2020(2), AND 2021(3)

SSME POWER LEVEL: 100%

SSME FLIGHT SOFTWARE: 84-SSME-0065R5

PAYLOAD:
PRIMARY
ERBS, OSTA-3
LFC, ORS

SECONDARY
IMAX, RME,
GAS (8), TLD,
APE, CANEX

ASTRONAUTS: COMMANDER: ROBERT CRIPPEN PILOT: JON MCBRIDE
MISSION SPECIALISTS: KATHRYN SULLIVAN, SALLY RIDE,
DAVID LEESTMA
PAYLOAD SPECIALISTS: MARC GARNEAU (CANADA)
PAUL SCULLY-POWER

● LANDING: KSC 10-13-84 12:26 EDT
HPFTP BEARING PURGES INITIATED - LANDING PLUS 50 HOURS 44 MINUTES

CHALLENGER PREVIOUS MISSIONS: STS-6, STS-7, STS-8, STS-11, AND STS-13 (04-06-84)

STS-13 SSME'S: 2109(1), 2020(2), AND 2012(3)

FIGURE 5-2. SHUTTLE FRF/STS LAUNCH GENERAL DATA (SHEET 16 OF 33)

STS-19 (MISSION 51-A)

ORBITER: DISCOVERY (OV-103)
OPF FLOW INITIATION: 09-14-84
OPF SSME PROCESSING TIME: 38 SHIFTS
ROLLOUTS: OPF 10-18-84 VAB 10-23-84
● LAUNCH: SCRUB 11-07-84 KSC 11-08-84
SSME'S: 2109(1), 2018(2), AND 2012(3)
SSME POWER LEVEL: 104%
SSME FLIGHT SOFTWARE: 84-SSME-0067R5
PAYLOAD:

<u>PRIMARY</u>	<u>SECONDARY</u>
TELESAT-H, SYNCOM IV-1, PALAPA B-2 RETRIEVAL HARDWARE WESTAR VI RETRIEVAL HARDWARE	MFR, MMU (2), DMOS, RME

ASTRONAUTS: COMMANDER: FREDERICK HAUCK PILOT: DAVID WALKER
MISSION SPECIALISTS: JOSEPH ALLEN, ANNA FISHER,
DALE GARDNER
● LANDING: KSC 11-16-84 07:00 EST
HPFTP BEARING PURGES INITIATED - LANDING PLUS 23 HOURS 45 MINUTES
DISCOVERY PREVIOUS MISSIONS: STS-14 (08-30-84)
STS-14 SSME'S: 2109(1), 2018(2), AND 2021(3)

STS-20 (MISSION 51-C)

ORBITER: DISCOVERY (OV-103)

OPF FLOW INITIATION: 11-16-84

OPF SSME PROCESSING TIME: 51 SHIFTS

ROLLOUTS: OPF 12-21-84 VAB 01-05-85

● LAUNCH: KSC 01-24-85 14:50 EST

SSME'S: 2109(1), 2018(2), AND 2012(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 84-SSME-0072R

PAYLOAD: DOD

ASTRONAUTS: COMMANDER: THOMAS MATTINGLY II PILOT: LOREN SHRIVER
MISSION SPECIALISTS: ELLISON ONIZUKA, JAMES BUCHLI
PAYLOAD SPECIALIST: GARY PAYTON

● LANDING: KSC 01-27-85 16:23 EST
HPFTP BEARING PURGES INITIATED - LANDING PLUS 44 HOURS 7 MINUTES

DISCOVERY PREVIOUS MISSIONS: STS-14 AND STS-19 (11-08-84)

STS-19 SSME'S: 2109(1), 2018(2), AND 2012(3)

STS-23 (MISSION 51-D)

ORBITER: DISCOVERY (OV-103)
OPF FLOW INITIATION: 01-28-85
OPF SSME PROCESSING TIME: 97 SHIFTS
ROLLOUTS: OPF 03-23-85 VAB 03-28-85
● LAUNCH: KSC 04-12-85 08:59 EST
SSME'S: 2109(1), 2018(2), AND 2012(3)
SSME POWER LEVEL: 100%
SSME FLIGHT SOFTWARE: 84-SSME-0068R3
PAYLOAD:

<u>PRIMARY</u> TELESAT I SYNCOM IV-3	<u>SECONDARY</u> CFES, AFE, PPE/SAS, SSIP (2), GAS (2)
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ASTRONAUTS:

<u>COMMANDER:</u> KAROL BOBKO	<u>PILOT:</u> DONALD WILLIAMS
<u>MISSION SPECIALISTS:</u> MARGARET SEDDON, JEFFREY HOFFMAN, DAVID GRIGGS	
<u>PAYLOAD SPECIALISTS:</u> CHARLES WALKER, JAKE GARN	

● LANDING: KSC 04-19-85 08:54 EST
HPFTP BEARING PURGES INITIATED - LANDING PLUS 40 HOURS 31 MINUTES
DISCOVERY PREVIOUS MISSIONS: STS-14, STS-19, AND STS-20 (01-24-85)
STS-20 SSME'S: 2109(1), 2018(2), AND 2012(3)

STS-24 (MISSION 51-B)

ORBITER: CHALLENGER (OV-099)

OPF FLOW INITIATION: 10-13-84

OPF SSME PROCESSING TIME: 60 SHIFTS

ROLLOUTS: OPF 03-07-85 VAB 04-10-85

● LAUNCH: KSC 04-29-85 12:02 EDT

SSME'S: 2023(1), 2020(2), AND 2021(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 85-SSME-0081

<u>PAYLOAD:</u>	<u>PRIMARY</u>	<u>SECONDARY</u>
	SPACELAB 3	GAS (2)

<u>ASTRONAUTS:</u>	<u>COMMANDER:</u> ROBERT OVERMYER	<u>PILOT:</u> FREDERICK GREGORY
	<u>MISSION SPECIALISTS:</u> DON LIND, NORMAN THAGARD,	
		WILLIAM THORNTON
	<u>PAYLOAD SPECIALISTS:</u> LODWEIJK VAN DEN BERG,	
		TAYLOR WANG

● LANDING: EAFB 05-06-85 09:11 PDT
HPFTP BEARING PURGES INITIATED - LANDING PLUS 38 HOURS 4 MINUTES

CHALLENGER PREVIOUS MISSIONS: STS-6, STS-7, STS-8, STS-11, STS-13, AND STS-17 (10-05-84)

STS-17 SSME'S: 2023(1), 2020(2), AND 2021(3)

STS-25 (MISSION 51-G)

ORBITER: DISCOVERY (OV-103)

OPF FLOW INITIATION: 04-19-85

OPF SSME PROCESSING TIME: 64 SHIFTS

ROLLOUTS: OPF 05-28-85 VAB 06-04-85

● LAUNCH: KSC 06-17-85 07:33 EDT

SSME'S: 2109(1), 2018(2), AND 2012(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 85-SSME-0083

<u>PAYLOAD:</u>	<u>PRIMARY</u>	<u>SECONDARY</u>
	SPARTAN-I	FPE
	MORELOS-A	FEE
	ARABSAT-IB	ADSF
	TELSTAR 3-D	GAS (6)

ASTRONAUTS: COMMANDER: DANIEL BRANDENSTEIN PILOT: JOHN CREIGHTON

MISSION SPECIALISTS: SHANNON LUCID, STEVEN NAGEL,
JOHN FABIAN

PAYLOAD SPECIALISTS: PATRICK BAUDRY (FRANCE),
SULTAN SALMAN AL-SAUD (SAUDI ARABIA)

● LANDING: EAFB 06-24-85 06:14 PDT
HPFTP BEARING PURGES INITIATED - LANDING PLUS 20 HOURS 21 MINUTES

DISCOVERY PREVIOUS MISSIONS: STS-14, STS-19, AND STS-23 (04-12-85)

STS-23 SSME'S: 2109(1), 2018(2), AND 2012(3)

STS-26 (MISSION 51-F)

ORBITER: CHALLENGER (OV-099)

OPF FLOW INITIATION: 05-11-85

OPF SSME PROCESSING TIME: 92 SHIFTS

ROLLOUTS: OPF 06-24-85 VAB 06-29-85

● ABORT: KSC 07-12-85 06:30 EDT

SSME'S: 2023(1), 2020(2), AND 2021(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 85-SSME-0084R4

PAYLOAD: PRIMARY
SPACELAB-2

SECONDARY

ASTRONAUTS: COMMANDER: C. GORDON FULLERTON PILOT: ROY BRIDGES
MISSION SPECIALISTS: STORY MUSGRAVE, ANTHONY ENGLAND,
KARL HENIZE

PAYLOAD SPECIALISTS: LOREN ACTON, JOHN-DAVID BARTOE

● LAUNCH: KSC 07-29-85

SSME'S: 2023(1), 2020(2), AND 2021(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 85-SSME-0084R11

● LANDING: EAFB 08-06-85 12:45 PDT
HPFTP BEARING PURGES INITIATED - LANDING PLUS 23 HOURS 45 MINUTES
DFRF PROCESSING TIME - 4 DAYS

CHALLENGER PREVIOUS MISSIONS: STS-6, STS-7, STS-8, STS-11, STS-13, STS-17, AND STS-24
(04-29-85)

STS-24 SSME'S: 2023(1), 2020(2), AND 2021(3)

STS-27 (MISSION 51-I)

ORBITER: DISCOVERY (OV-103)

OPF FLOW INITIATION: 06-29-85

OPF SSME PROCESSING TIME: 70 SHIFTS

ROLLOUTS: OPF 07-30-85 VAB 08-06-85

● LAUNCH: KSC 08-27-85 06:58 EDT

SSME'S: 2109(1), 2018(2), AND 2012(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 85-SSME-0088

PAYLOAD:
PRIMARY
ASC-1
AUSAT-1
LEASAT IV-F4

SECONDARY
PVOTS

ASTRONAUTS: COMMANDER: JOE ENGLE PILOT: RICHARD COVEY
MISSION SPECIALISTS: WILLIAM FISHER, JAMES VAN HOFTEN,
MIKE LOUNGE

● LANDING: EAFB 09-03-85 06:16 PDT
HPFTP BEARING PURGES INITIATED - LANDING PLUS 19 HOURS 44 MINUTES

DISCOVERY PREVIOUS MISSIONS: STS-14, STS-19, STS-20, STS-23, AND STS-25 (06-17-85)

STS-25 SSME'S: 2109(1), 2018(2), AND 2012(3)

FRF-05

ORBITER: ATLANTIS (OV-104)

SSME INSTALLATION: 06-11-85, 06-12-85, AND 06-13-85

ROLLOUTS: OPF 08-09-85 VAB 08-30-85

● FRF-05: 09-12-85

SSME'S: 2011(1), 2019(2), AND 2017(3)

SSME POWER LEVEL: 100%

SSME FRF-05 SOFTWARE: 85-SSME-0086R6

STS-28 (MISSION 51-J)

ORBITER: ATLANTIS (OV-104)

OPF FLOW INITIATION: DNA - FRF TURNAROUND

OPF SSME PROCESSING TIME: DNA - FRF TURNAROUND

ROLLOUTS: OPF 08-09-85 VAB 08-30-85

● LAUNCH: KSC 10-03-85 11:15 EDT

SSME'S: 2011(1), 2019(2), AND 2017(3)

SSME POWER LEVEL: CLASSIFIED

SSME FLIGHT SOFTWARE: 85-SSME-0087R4

<u>PAYLOAD:</u>	<u>PRIMARY</u>	<u>SECONDARY</u>
	DOD (CLASSIFIED)	

<u>ASTRONAUTS:</u>	<u>COMMANDER:</u> KAROL BOBKO	<u>PILOT:</u> RONALD GRABE
	<u>MISSION SPECIALISTS:</u> ROBERT STEWART, DAVID HILMERS	
	<u>PAYLOAD SPECIALIST:</u> WILLIAM PAILES	

● LANDING: EAFB 10-07-85 10:00 PDT
HPFTP BEARING PURGES INITIATED - LANDING PLUS 15 HOURS 30 MINUTES

ATLANTIS PREVIOUS MISSIONS: NONE

STS-30 (MISSION 61-A)

ORBITER: CHALLENGER (OV-099)

OPF FLOW INITIATION: 08-12-85

OPF SSME PROCESSING TIME: 102 SHIFTS

ROLLOUTS: OPF 10-12-85 VAB 10-16-85

● LAUNCH: KSC 10-30-85 12:00 EST

SSME'S: 2023(1), 2020(2), AND 2021(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 85-SSME-0092R6

PAYLOAD: PRIMARY
 SPACELAB D-1

SECONDARY

ASTRONAUTS: COMMANDER: HENRY HARTSFIELD PILOT: STEVEN NAGEL

MISSION SPECIALISTS: JAMES BUCHLI, BONNIE DUNBAR,
 GUION BLUFORD

PAYLOAD SPECIALISTS: WUBBO OCKELS (NETHERLANDS),
 ERNST MESSERSCHMID (W. GERMANY),
 REINHARD FURRER (W. GERMANY)

● LANDING: EAFB 11-06-85 09:44 PST
 HPFTP BEARING PURGES INITIATED - LANDING PLUS 22 HOURS 16 MINUTES

CHALLENGER PREVIOUS MISSIONS: STS-6, STS-7, STS-8, STS-11, STS-13, STS-17, STS-24,
 AND STS-26 (07-29-85)

STS-26 SSME'S: 2023(1), 2020(2), AND 2021(3)

STS-31 (MISSION 61-B)

ORBITER: ATLANTIS (OV-104)

OPF FLOW INITIATION: 10-12-85

OPF SSME PROCESSING TIME: 58 SHIFTS

ROLLOUTS: OPF 11-08-85 VAB 11-12-85

● LAUNCH: KSC 11-26-85 19:30 EST

SSME'S: 2011(1), 2019(2), AND 2017(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 85-SSME-0094R3

PAYLOAD: PRIMARY
EASE/ACCESS
MORELOS B
SATCOM KU-2
AUSSOT

SECONDARY

ASTRONAUTS: COMMANDER: BREWSTER SHAW PILOT: BRYAN O'CONNOR

MISSION SPECIALISTS: MARY CLEAVE, SHERWOOD SPRING.
JERRY ROSS

PAYLOAD SPECIALISTS: CHARLES WALKER, RODOLFO NERI VELA (MEXICO)

● LANDING: EAFB 12-03-85 13:34 PST
HPFTP BEARING PURGES INITIATED - LANDING PLUS 23 HOURS 57 MINUTES

ATLANTIS PREVIOUS MISSIONS: STS-28 (10-03-85)

STS-28 SSME'S: 2011(1), 2019(2), AND 2017(3)

FIGURE 5-2. SHUTTLE FRF/STS LAUNCH GENERAL DATA (SHEET 27 OF 33)

STS-32 (MISSION 61-C)

ORBITER: COLUMBIA (OV-102)

OPF FLOW INITIATION: 10-28-85

OPF SSME PROCESSING TIME: 65 SHIFTS

ROLLOUTS: OPF 11-22-85 VAB 12-02-85

● LAUNCH: KSC 01-12-86 06:55 EST

SSME'S: 2015(1), 2018(2), AND 2109(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 84-SSME-0090R6

PAYLOAD: PRIMARY
SATCOM KU-2

SECONDARY
MSL-2
GAS BRIDGE

ASTRONAUTS: COMMANDER: ROBERT GIBSON PILOT: CHARLES BOLDEN
MISSION SPECIALISTS: FRANKLIN CHANG-DIAZ, STEVEN HAWLEY,
GEORGE NELSON
PAYLOAD SPECIALISTS: ROBERT CENKER, BILL NELSON

● LANDING: EAFB 01-18-86 06:00 PST
HPFTP BEARING PURGES INITIATED - LANDING PLUS 32 HOURS

COLUMBIA PREVIOUS MISSIONS: STS-1, STS-2, STS-3, STS-4, STS-5, AND STS-9 (11-28-83)

STS-9 SSME'S: 2011(1), 2018(2), AND 2019(3)

STS-33 (MISSION 51-L)

ORBITER: CHALLENGER (OV-099)

OPF FLOW INITIATION: 11-11-85

OPF SSME PROCESSING TIME: 71 SHIFTS

ROLLOUTS: OPF 12-16-85 VAB 12-21-85

● LAUNCH: KSC 01-28-86 11:38 EST

SSME'S: 2023(1), 2020(2), AND 2021(3)

SSME POWER LEVEL: 104%

SSME FLIGHT SOFTWARE: 86-SSME-0104

PAYLOAD:
PRIMARY
TDRS-B
SPARTAN

SECONDARY

ASTRONAUTS: COMMANDER: FRANCIS SCOBEE PILOT: MICHAEL SMITH

MISSION SPECIALISTS: JUDITH RESNIK, ELLISON ONIZUKA,
RONALD MCNAIR

PAYLOAD SPECIALISTS: GREGORY JARVIS,
CHRISTA MCAULIFFE (TEACHER IN SPACE)

● LANDING: ORBITER LOST

CHALLENGER PREVIOUS MISSIONS: STS-6, STS-7, STS-8, STS-11, STS-13, STS-17, STS-24,
STS-26, AND STS-30 (10-30-85)

STS-30 SSME'S: 2023(1), 2020(2), AND 2021(3)

FRF-06

ORBITER: DISCOVERY (OV-103)

SSME INSTALLATION: 01-10-88, 01-24-88, AND 01-26-88

ROLLOUTS: OPF 06-21-88 VAB 07-04-88

- FRF-06: 08-10-88

SSME'S: 2019(1), 2022(2), AND 2028(3)

SSME POWER LEVEL: 100%

STS-26R

ORBITER: DISCOVERY (OV-103)

OPF SSME PROCESSING TIME: DNA (FRF TURNAROUND)

ROLLOUTS: OPF 06-21-88 VAB 07-04-88

- LAUNCH: KSC 09-29-88 11:37 EDT

SSME'S: 2019(1), 2022(2), AND 2028(3)

SSME POWER LEVEL: 104%

PAYLOAD: TDRS-C

ASTRONAUTS: COMMANDER: FREDRICK HAUCK PILOT: RICHARD COVEY
MISSION SPECIALISTS: GEORGE NELSON, JOHN LOUNGE,
DAVID HILMERS

- LANDING: EAFB 10-03-88 09:37 PDT
HPFTP BEARING PURGE INITIATED - LANDING PLUS 29 HOURS

DISCOVERY PREVIOUS MISSIONS: STS-14, STS-19, STS-20, STS-23, STS-25, AND STS-27

STS-27 SSME'S: 2109(1), 2018(2), AND 2012(3)

STS-27R

ORBITER: ATLANTIS (OV-104)

OPF PROCESSING TIME: DNA (REFURBISHED ORBITER)

ROLLOUTS: OPF 10-22-88 VAB 11-02-88

● LAUNCH: KSC 12-02-88 09:30 EST

SSME'S: 2027(1), 2030(2), AND 2029(3)

SSME POWER LEVEL: 104%

PAYLOAD: DOD (CLASSIFIED)

ASTRONAUTS: COMMANDER: ROBERT L. GIBSON PILOT: GUY GARDNER
MISSION SPECIALISTS: WILLIAM SHEPHERD, JERRY L. ROSS,
RICHARD M. MULLANE

● LANDING: EAFB 12-06-88 15:35 PST
HPFTP BEARING PURGE INITIATED - LANDING PLUS 30 HOURS 25 MINUTES

ATLANTIS PREVIOUS MISSIONS: STS-28 AND STS-31

STS-31 SSME'S: 2011(1), 2019(2), AND 2017(3)

STS-29R

ORBITER: DISCOVERY (OV-103)

OPF FLOW INITIATION: 10-09-88

ROLLOUTS: OPF 01-23-89 VAB 02-03-89

● LAUNCH: KSC 03-13-89 09:57 EST

SSME'S: 2031(1), 2022(2), AND 2028(3)

SSME POWER LEVEL: 104%

PAYLOAD: TDRS

ASTRONAUTS: COMMANDER: MICHAEL L. COATS PILOT: JOHN E. BLAHA

MISSION SPECIALISTS: JAMES F. BUCHLI, ROBERT C. SPRINGER,
JAMES P. BAGIAN

● LANDING: EAFB 03-18-89 06:36 PST
HPFTP BEARING PURGE INITIATED - LANDING PLUS 27 HOURS 44 MINUTES

DISCOVERY PREVIOUS MISSIONS: STS-14, STS-19, STS-20, STS-23, STS-25, STS-27 AND
STS-26R

STS-26R SSME'S: 2019(1), 2022(2), AND 2028(3)

NOTES

